MANUAL OF INSTRUCTIONS

FOR

FOREST DISEASE SURVEY

USING RANDOMLY SELECTED TEMPORARY PLOTS

CALIFORNIA

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FOREST SERVICE
CALIFORNIA REGION
MAY, 1963

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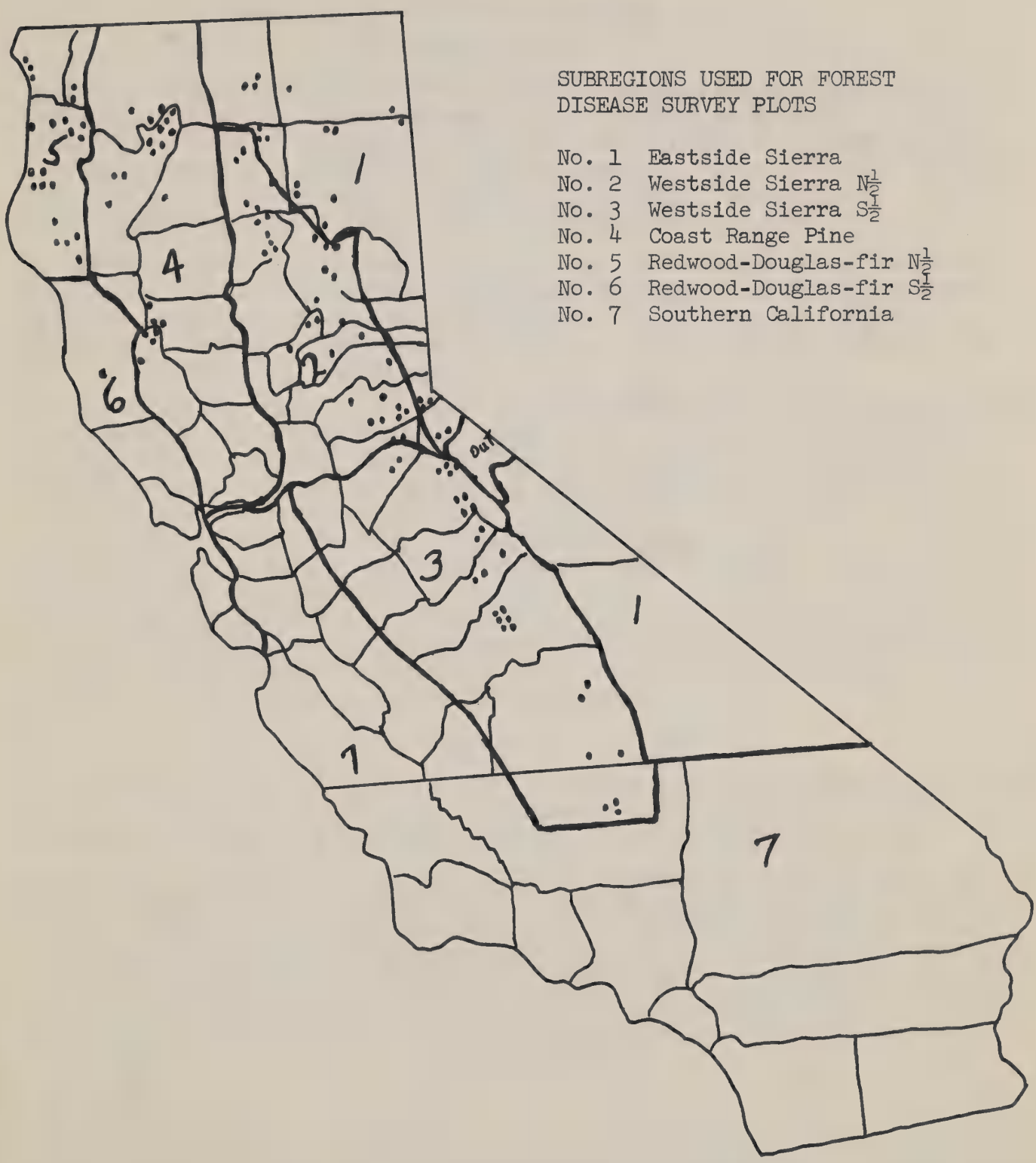

SUBREGIONS USED FOR FOREST DISEASE SURVEY PLOTS

No. 1 Eastside Sierra
No. 2 Westside Sierra N½
No. 3 Westside Sierra S½
No. 4 Coast Range Pine
No. 5 Redwood-Douglas-fir N½
No. 6 Redwood-Douglas-fir S½
No. 7 Southern California

MANUAL OF INSTRUCTIONS FOR FOREST DISEASE SURVEY*

USING RANDOMLY SELECTED TEMPORARY PLOTS

California

Douglas R. Miller and H. H. Bynum, Jr.

A. INTRODUCTION

Present trends toward the practice of more intensive forestry in California must be supported by better information on the management and protection of wildland resources. As emphasized in the Timber Resource Review, more information about tree diseases is urgently needed. There are fairly reliable figures for the gross amount of timber in the State, but estimates of losses from diseases and heart rots do not have comparable accuracy.

As timber becomes more valuable, there is an increasing need for reliable data on the prevalence and identity of diseases attacking commercially important species. Such information will be useful to forest managers in planning the time and intensity of the cut as well as the silvicultural treatment of an area during and following harvest.

Recognizing these needs, interested land managers pooled their ideas to determine the type of information that would be of the greatest use and asked the Pacific Southwest Forest and Range Experiment Station to work out a statistically sound procedure for collecting the required data. Since commercial timber type alone extends to 17.3 million acres in California--and only a limited amount of survey funds is available for use during any one year--it was decided to obtain the required survey data through a sampling method using randomly selected plots of a temporary nature. This type of sampling permits the use of statistical methods to determine the limits of reliability. By following uniform and strictly objective procedures on sampling and record keeping, the data will be cumulative--that is, each succeeding year's data will add to and strengthen previous information.

B. PURPOSE

The purpose of this manual is to make pertinent information readily available to the men in the field actually conducting the forest disease survey. It also may be used as a guide when planning a disease survey elsewhere.

The survey's purpose is to secure reliable information on the disease situation in forested areas throughout the State of California. All commercial timber lands, regardless of ownership, will be sampled (with the owner's permission) by the random temporary plot system. Enough plots will be taken (estimated at 1,200 to 1,500) to give reliable data on the common diseases and to be indicative of the existing conditions on less prevalent diseases. Data will be taken in code so it can be summarized on IBM machines.

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*The statewide disease survey methods using randomly selected temporary plots and the codes employed for recording field data evolved from procedures developed by J. W. Kimmey in 1956 for checking permanent sample plots. The sampling system here described was developed in consultation with W.G. O'Regan, Pacific Southwest Station Statistician, and was used by Station pathologists on state-wide disease survey from 1958 to July 1961. Disease survey has been the responsibility of the Regional Office of the Forest Service since the latter date.

C. METHODS OF SELECTING AND LOCATING PLOTS

1. Subregions

The forested area of the State has been divided into seven subregions. The five subregions formerly used for timber survey (their divisions based on natural differences of topography, timber species, growing conditions, etc.) were selected as primary divisions. Two of these were further divided to save travel time, simplify the assignment of plots and allow the results of the survey to be applied to a smaller unit of area.

Each of the seven subregions is handled as a unit, and a set of plots drawn for it alone. This allows an estimate of the statistical reliability of the data within predetermined limits to be made for each subregion. The subregions now used (see map), the number of townships containing some commercial timber in each, and their code numbers are listed below:

Code	Subregion	Numbered Townships
1	Eastside Sierra (ES)	285
2	Westside Sierra N 1/2 (WS N 1/2)	236
3	Westside Sierra S 1/2 (WS S 1/2)	195
4	Coast Range Pine (CRP)	244
5	Redwood-Douglas-fir N 1/2 (RDF N 1/2)	166
6	Redwood-Douglas-fir S 1/2 (RDF S 1/2)	111
7	Southern California (So. Cal.)	49

The survey is being conducted in two phases. One phase, containing by far the greater number of plots, will sample the diseases on timber growing within 1/4 mile of either side of passable roads. The other phase will sample disease conditions of timber growing at greater distances from the road (back country plots) and will be limited to about one plot for each 20 taken along the road. The two sets of plots will be drawn separately and the data summarized for each. With enough samples it can be determined whether there is any significant difference in the disease situation between the back country population and the more intensively sampled area. If no significant difference is found between the populations, the results will be combined for a single mean representative of an entire subregion, using appropriate weighting factors.

Levels of reliability for the survey will be referenced to particular disease-host combinations for each of the subregions. A similar level of reliability will be maintained for all subregions with the possible exception of Southern California, which will probably be at a lower

level because less acreage is involved with no greater percentage of coverage anticipated.

The two economically most important disease-host combinations will be used as indices. For example, in the three subregions in the Sierra, dwarfmistletoe on ponderosa and Jeffrey pine and a heart rot (Echinodontium tinctorium) in red and white fir will be used as indices. A confidence level of 90 percent will be used. The survey will be continued until the confidence limits are reduced to ± 10 percent of the value of the sample mean.

However, the most economical method for attaining an estimate with the required confidence limits involves a primary sample of plots which is judged to be nearly but not more than adequate. From the results of the first estimate, the approximate number of additional plots needed to bring the estimate within the required limits can be calculated. The procedure may need to be repeated more than once if the primary sample size is much smaller than required.

It is estimated that 10 years will be needed to achieve this order of reliability--with our present funds and available technical manpower. As soon as the sample size is large enough, probably after 5 or 6 years, an interim analysis should be made with all available data for some of the more prevalent diseases.

2. Selection of Plots

Several steps are required in selecting plots and certain precautions must be observed so that selections are free of bias. The steps include:

a. Numbering of Townships. The commercial timber within the State is outlined as accurately as possible on a map having a township grid. Next those townships or partial townships in each subregion bearing some commercial timber are numbered consecutively beginning with the most westerly township in the northern tier and proceeding eastward to the last township in that tier. The next tier south then is numbered from left to right continuing with the numbers from the first tier. This procedure is followed until all timbered townships within a subregion are numbered. The total number of townships supporting merchantable timber (as determined from type maps) for each subregion is shown on page 2.

b. Drawing Township Numbers. Before township drawing starts, the number of plots to be drawn at any one time for a subregion must be determined. There are two major factors influencing the number of plots to be selected at any one drawing. The greater the number of plots drawn at one time, the nearer they will be one to another on the ground, hence the easier it will be to go from plot to plot when they are being examined. The time needed to locate and take data on a plot varies between 2 and 8 hours depending upon: distance between plots, condition of road being traveled, proximity of plot to road, steepness of slope at plot site, density, size, and species of timber on plot, density species and height of brush on plot, and density, type and height of debris on ground.

Close association of plots may mean the difference between taking data on one or up to four plots per crew day. The first major factor then is that from cost and convenience alone it would be best to make a single drawing of all the plots needed to give a significant and reliable estimate of the disease situation in each subregion. This is not a desirable procedure because an interim analysis is needed to determine the progress of the survey as well as to obtain a statistical estimate of the number of plots yet needed. Also, should it be necessary to terminate the survey prematurely a greater number of plots probably would remain yet to be taken before a statistically sound analysis could be made.

The second major factor to be considered is the need of making an interim analysis of survey records. Before the data can be statistically analyzed every drawn plot within a subregion either must be accepted and data taken on it or it must be rejected as failing to meet prescribed requirements. If for example an interim analysis is made after 5 years, then every plot in the subregion must be examined by that time or the total number of plots taken must consist of consecutively numbered ones (beginning with plot number one)--otherwise any computations made from the data will not be statistically sound.

A third factor to consider when deciding upon the number of plots to be drawn at a given time is the relation of the number that will be eliminated, for various reasons, to the number that will be accepted. This relationship varies between subregions, but past experience indicates that roughly for each two plots on which data are taken one plot will be eliminated. This means that about 50 percent more draws must be made than the number of plots needed. After considering all factors it was decided to draw a two-year supply of plots and see how the system works out.* It is proposed that the second drawing supply enough plots for three more years at which time a preliminary analysis is to be made. From this analysis it is hoped that the total number of plots yet needed for the level of accuracy required, can be determined. The remainder of needed plots is to be drawn at a single drawing after the analysis.

In determining plot locations, the first step after the timbered townships have been numbered is to draw townships. This is done by placing as many numbered metal tags in a rigid container (aluminum tags the size of a quarter were used) as there are townships in a subregion. These are thoroughly shaken to insure complete "mixing" and then a tag is drawn: the number of the tag is the township number to be used. When the township number has been recorded on the "draw-sheet" (see sample in appendix page A-3) the tag is returned to the container and after thorough shaking another tag is drawn. This process is repeated until the designated number of townships (plots has been reached.)

* The first drawing was made, most of the plots were taken, the method of survey was perfected; and plot taking is well into the second drawing in May, 1961.

c. Drawing Section Numbers. The next step in locating a plot is to determine the section in which the plot will "fall." Tags numbered from 1 to 36 are placed in a container and one is drawn for each township-draw. When the section number has been recorded on the draw-sheet the tag is returned to the section-tag container. The map must be consulted to be sure the section selected is in both the subregion and in timber type. (Where subregion boundaries follow natural topographical features, townships may be divided between two subregions. Similarly when a type line is drawn along the foothill country a portion of the township may be eliminated because of known brush, etc. Occasionally a section is divided by a subregion boundary or by a type boundary. For these reasons a section-draw may have to be eliminated.) Sometimes a township is short one or more tiers of sections. Then the draw must be checked to see that the section drawn is actually present on the ground. When a section is eliminated the township-draw must be discarded and a complete new draw made.

d. Locating Plot Within the Section. After the section has been determined the location of the point within the section is established. This is done by placing tags numbered 1 to 80 in a container and making two separate draws (the tag is returned to the container after each draw). The first will determine the number of chains east of the northwest corner and the second will determine the number of chains south of the first draw. For example, if the first number is 21 and the second 67, the plot will be located 21 chains east and 67 chains south of the northwest corner of the section drawn in the previous step. Should the point fall outside the subregion, in non type, or outside the section (in narrow sections or parts of sections), then the plot is discarded and a complete new drawing is made beginning with the township.

e. Locating "Initial Point" on Map. The point just determined is known as the "initial point" and is located on the work map. (Usually the latest edition of a 1/2"-to-the mile forest map with Forest Service ownership shown in green or a State of California Division of Forestry map of an individual county.) After the point has been located its draw-number is written with black permanent ink on a small (about 1/3-inch diameter) gummed green plastic dot. The dot then is pressed over the initial point on the map and the locations of untaken plots are readily visible when the map is being examined preparatory to planning a day's travel schedule. When a plot has been either "taken" or "rejected" its corresponding plastic dot is withdrawn from the map thus leaving dots for only those plots yet to be examined.

f. Establishing "Reference Point" at Nearest Road. After the initial point has been located on the work map, a line is drawn (with soft lead pencil) from it to the nearest point on the nearest navigable road in the same subregion. Navigable road is defined as one being passable by the vehicle in which the survey men are traveling on the day the plot is examined. The intersection of the line with the road is known as the "reference point" and it is from here the actual measurements on the ground are begun.

g. Locating Reference Point. When locating the reference point on the road, some point on the map is selected that can be identified on the ground such as a stream crossing, house, etc. The distance from this closest identifiable point (known as orientation point) to the reference point on the road is measured on the map and a definite speedometer distance set such as 1.3 miles. This distance is measured off by the car speedometer when enroute to the locale of the reference point. There are two conditions under which this distance can be corrected--one when a location poster is found and a new but shorter distance can be measured, the other when the road has a peculiar bend or other characteristic that is actually identifiable when it is reached.

When a new road is encountered (logging road, mining road, etc., not shown on the map) which is nearer to the initial point than the road shown, the plot should be moved to its proper place on the new road. The rest of the draw-information (distance, azimuth, etc.) should be applied as though no move had been made. In back country plots, the initial point, reference point, and plot print are all at the same place.

h. Determining Distance From Road and Side of Road for Plot. The distance from the road and the side of the road on which the plot will be located is determined by placing tags numbered from 2 to 22 and 102 to 122 in a single container. Since the number, size, and health of trees may be influenced by the disturbance created by road construction, a strip of 2 chains on each side of the road is omitted from consideration. The draw is made in the usual manner. Tags numbered from 2 to 22 give the distance (on the same side of the road as the initial plot) to the beginning of the plot strip--known as the "plot point." Tags numbered from 102 to 122 give the distance of 2 to 22 chains from the road but on the opposite side or across the road from the initial plot. Distances to plot points are always measured at right angles to the road from the reference point.

Plots initially falling within this one-fourth mile strip on either side of the road are handled in the same manner. That is, they are moved to the road and the distance from the road and the side of the road are drawn. This allows any plot to fall any place within the belt of timber being sampled.

i. Determining the Azimuth. The last step in determining the location of the plot is drawing the azimuth. The azimuth is determined by putting 360 consecutively numbered tags in a container and drawing one tag; its number will be the azimuth on which the plot strip starts.

If upon reaching the starting point for the plot and using the compass to determine the course (azimuth), it is obvious that 25 trees over eleven inches in diameter will not be found on a strip one-half-chain-wide and 50 chains long (2-1/2 acres) the plot is discarded as being out of type. This may be due to brush, recent cutover, fire, reservoir, or other causes.

D. PLOT PROCEDURE

1. Timber Plot

a. Determination of Site. One of the first duties to be performed after reaching the vicinity of the plot (supporting enough timber to warrant taking data) is to determine the growing site. In other than the Douglas-fir and Redwood types this is done by selecting an average dominant tree of ponderosa pine, sugar pine or white fir and obtaining its age, height and diameter. The tree should be around 300 years of age for best results, but other age classes can be used when necessary. (See Site, item 9, for Douglas-fir and Redwood site determination.) The site tree should be on or near the disease plot. The age can be secured by boring the selected site tree, counting the whorls of limbs (when possible) or counting the rings of a stump (when the corresponding top is in evidence and undisturbed and the felled tree used for the site tree). Height of standing trees usually will be determined with an Abney hand level. If there is any question as to whether the site tree is representative of the growth conditions, additional site determinations should be made.

b. Plot Size and Shape. The plot will consist of the first 25 coniferous trees over 11 inches in diameter located on a strip one-half-chain-wide, and the first 5 broadleafed trees (over 11 inches in diameter) encountered while taking data on the 25 conifers. It will start at the plot point and continue along the designated azimuth until 25 trees have been encountered or for a distance of 10 chains. If the required number of trees have not been examined by then, a 90° off-set of one chain to the left is made and the strip continued in the reverse direction for 20 chains. If more trees still are needed, another off-set to the left is made--this time of two chains--the course again is reversed (now following original azimuth) and the strip continued for 20 more chains or until 25 trees have been examined. If the 25 trees are not found on the plot after 50 chains of strip are covered the plot is rejected as being understocked. See sketch of sample plots in Appendix page A-31.

c. Method of Work. As the strip is worked all trees over 11 inches DBH are thoroughly examined. The pathologist carries a pair of good binoculars, a belt axe, and small plastic envelopes or containers for disease specimens, in addition to a diameter tape, 6-foot tape, etc. He uses the binoculars to examine the crown and bole of each tree encountered on the plot strip. This means a great deal of walking as the crown must be viewed from all angles and at a distance great enough to insure good visibility of the tree's top by the observer. The pathologist then circles the tree trunk looking up the bole for conks or other evidence of heart rot, wounds, cankers, etc., that might be hidden by the foliage when viewed at a distance of a few feet or more from the trunk. After the crown and trunk of the tree have been thoroughly examined the bole is tapped or sounded for heart rot with the blunt edge or pole of the axe head. If there is any doubt about the existence of heart rot in a tree bole it should be bored and the core examined. When unknown foliage diseases,

cankers, heart rots, etc., are found, samples should be collected for laboratory identification. These should be collected with care, kept in good condition, and submitted while in a fresh state. When any evidence of a root disease is present, a sample should be collected for analysis in the laboratory. Also, roots of recently windthrown trees--observed on or near the plot strip--should be examined carefully for root diseases particularly Fomes annosus, Armillaria mellea, and Polyporus schweinitzii. Dying or recently killed (from unknown causes) reproduction should be checked for root diseases such as F. annosus and A. mellea.

The plot always must be confined to the 1/4-mile strip of timber on the same side of the road from which it started. When a plot strip would cross the boundary it is reversed as soon as the boundary is reached even though 10 chains have not yet been traversed (example 2 in Appendix page A-31). If the plot strip is approaching the road on which the reference point is situated, it (the strip) is reversed at a distance of 2 chains from the road. If the strip approaches a road other than the one on which the reference point is situated the road can be crossed but no data are to be taken within 2 chains on either side. Roads of simple construction where little, if any, grading was done while building can be ignored. Under most forest conditions the 25 trees are found on the plot before many chains of strip have been traversed. The distance is measured by pacing and the course or azimuth followed with a hand compass.

2. Pole Plot

When the 25th tree on the timber plot is reached and the data recorded, the pole data are taken. This plot starts with the last tree and retraces the timber plot for 2 chains. This means the poles are examined on the last 2 chains of the timber plot (1/2 by 2 chains). The poles range in size from 5.0 inches diameter breast high (DBH) to 10.9 inches.

3. Seedling and Sapling Plot

The seedlings and saplings are counted on the last 1/2 chain of the pole plot after the poles have been examined. The seedling and sapling plot is 1/2-by-1/2-chain square. Seedlings and saplings range in size from 6 inches high (two-year-old or established seedlings) to 4.9 inches in diameter.

E. RECORDING PLOT DATA

1. Timber Plots (Trees over 11 inches DBH)

Much of the general information can be filled in on the data sheets before arriving at the plot point or before the plot is started. The Timber Plot Data Sheet is divided into 4 general boxes. Information in the Facilitating Data box is filled in with no codes being used. Items in the other three boxes, (General Data, Tree Data, and Pathological Data) are numbered consecutively

with each number corresponding to the number appearing in the text opposite the description and codes relating to the item. This was done to facilitate answering questions relating to items on the form. For example, if a question on "bole wounds" (number 25 on the data sheet) arises it will be answered in the explanation appearing in description number 25 (pages 18-19) under Recording Plot Data.

a. Facilitating Data. The box on the right side of the heading of the "Timber Plot Data Sheet" must be completed but no codes are used.

(1) Location. The township, range, section, and meridian in which the plot point (starting point of plot strip) is situated must be recorded. Care should be used to avoid recording the draw section, township, etc., and to make sure the section recorded is the one in which the plot point fell.

(2) Site Tree. Record the species, diameter (breast high), height and age of the site tree.

(3) Number of Trees on Plot. The number of trees always will be 25 for conifers and from 0 to 5 for broadleaf trees. These will be recorded as two groups: 25 for conifers and as many hardwoods as are examined (up to 5). For example, 25-3 means in addition to the 25 conifers, 3 hardwoods were examined.

(4) Data by. Insert name of person examining the trees and calling the data.

(5) Notes by. Insert name of data recorder.

(6) Date. Record date plot is taken.

b. General Data

(1) Subregion. Data for the seven subregions are to be kept separate. A one-digit number is used for coding subregions as follows:

Code	Name
1	Eastside Sierra (ES)
2	Westside Sierra N1/2 (WS-N1/2)
3	Westside Sierra S1/2 (WS-S1/2)
4	Coast Range Pine (CRP)
5	Redwood = Douglas-fir N1/2 (RDF-N1/2)
6	Redwood = Douglas-fir S1/2 (RDR-S1/2)
7	Southern California (SC)

(2) County. Record the code for the county in which the plot is located. If the plot strip crosses a county line, record the county having the plot point as containing the plot. A two-digit number is used for coding counties as follows:

Code	County	Code	County
01	Alameda	30	Orange
02	Alpine	31	Placer
03	Amador	32	Plumas
04	Butte	33	Riverside
05	Calaveras	34	Sacramento
06	Colusa	35	San Benito
07	Contra Costa	36	San Bernardino
08	Del Norte	37	San Diego
09	El Dorado	38	San Francisco
10	Fresno	39	San Joaquin
11	Glenn	40	San Luis Obispo
12	Humboldt	41	San Mateo
13	Imperial	42	Santa Barbara
14	Inyo	43	Santa Clara
15	Kern	44	Santa Cruz
16	Kings	45	Shasta
17	Lake	46	Sierra
18	Lassen	47	Siskiyou
19	Los Angeles	48	Solano
20	Madera	49	Sonoma
21	Marin	50	Stanislaus
22	Mariposa	51	Sutter
23	Mendocino	52	Tehama
24	Merced	53	Trinity
25	Modoc	54	Tulare
26	Mono	55	Tuolumne
27	Monterey	56	Ventura
28	Napa	57	Yolo
29	Nevada	58	Yuba

(3) Ownership. Ownership should be secured from the district ranger's office if it isn't shown as being National Forest land on a forest map. Ownership will be recorded in code. If the plot strip crosses an ownership line, the plot will be recorded as though it was all located in the same ownership as the plot point. A two-digit number is used for coding ownership as follows:

Code	Ownership
01	National Forest - available
02	National Parks and Monuments
03	Indian Lands - available
04	B.L.M. Land - outside of grazing district
05	B.L.M. Land - inside of grazing district
06	Other Federal - available
07	National Forest - reserved
08	Other Federal - reserved
11	State - available
17	State - reserved
21	County - available
22	County - reserved

Code	Ownership
23	Municipal - available
27	Municipal - reserved
30	All private (to be used when information for codes 31, 32 and 41 is not available.)
31	Industrial
32	Other Private
41	Farm
99	Any area for which ownership is not known or classified

(4) National Forests. Plot data are to be recorded by the National Forest in which the plot point is located, even though a plot actually crosses a forest boundary. A two-digit number is used for coding National Forests as follows:

Code	Forest	Code	Forest
00	Outside National Forest	10	Plumas
01	Angeles	11	San Bernardino
02	Cleveland	12	Sequoia
03	Eldorado	13	Shasta
04	Inyo	14	Sierra
05	Klamath	15	Six Rivers
06	Lassen	16	Stanislaus
07	Los Padres	17	Tahoe
08	Mendocino	18	Trinity
09	Modoc		

(5) Plot Number. Disease survey plots are numbered separately for each subregion. They are numbered consecutively as they are taken irrespective of the draw number or year taken. Plots rejected for any reason are not numbered. A three-digit code is used in plot numbers as: 001 - 009, 010 - 099, 100 - 999.

(6) Plot Size. Plots will vary in size from about 1/10 acre to 2-1/2 acres. The actual strip length in chains will be recorded at the bottom of the data sheet. For example, 6-7/12 chains and the code for the correct size is used. The code for 6-7/12 chains is 1. A one-digit number is used for coding plot size as below:

Code	Acreage	Strip length in chains
0	.10	0 - 3.49
1	.25	3.5 - 7.49
2	.50	7.5 - 12.49
3	.75	12.5 - 17.49
4	1.00	17.5 - 22.49
5	1.25	22.5 - 27.49
6	1.50	27.5 - 32.49
7	1.75	32.5 - 37.49

Code	Acreage	Strip length in chains
8	2.00	37.5 - 44.99
9	2.50	45.0 - 50.00

(7) Measurement Number. Since these are temporary plots, this will be the first measurement, and the code will be 1.

(8) Year. The last two digits of the year will be used as the code number. For example, 58 will be used for 1958, 59 for 1959, 60 for 1960, etc.

(9) Site. The method of site determination already has been described. The site indexes of both Regions 5 and 6 are used in California. Region 6 site curves are used in the Douglas-fir and Redwood types (including stands containing western hemlock, grand fir, sitka spruce, and Port Orford cedar) in the Counties of Del Norte, Humboldt, Mendocino, Sonoma, Marin, San Mateo, Santa Clara, Santa Cruz, Monterey, and that part of the Six Rivers National Forest lying in Trinity County. Although the basis for site determination differs somewhat between regions, the 5 site classes of Region 6 are coded with sites 1-5 of Region 5. The data can be separated and the Region 6 sites will carry their true site numbers. The Region 5 site curves are used in the rest of the State--that is, in the pine, pine-fir and true fir types in the Counties named and in all types in the other counties. The site curves for Regions 5 and 6 appear in the Appendix. A single code number is used as follows:

Mixed Pine	Code	Douglas-fir = Redwood
Super site index 200	0	
High site index 175	1	Very high site index 200
Medium high index 150	2	High site index 170
Medium low index 125	3	Medium site index 140
Low site index 100	4	Low site index 110
Very low index 75	5	Very low index 80

(10) Elevation. Elevations are to be secured from reliable contour maps, adjacent bench marks, or altimeter to the nearest 100 feet. Two code numbers are used as 01 for 100 feet, 02 for 200 feet, 23 for 2,300 feet up to 99 for 9,900 feet and over.

(11) Aspect. Record the aspect as observed on the plot. If the plot strip has more than one aspect, use the one applicable to the greatest portion of the plot. Codes are:

Code	Aspect	Code	Aspect
0	Level	5	South
1	North	6	Southwest
2	Northeast	7	West
3	East	8	Northwest
4	Southeast		

(12) Topographic Characteristics. Record the type of topography in which the plot occurs. Codes and descriptions are:

Code	Description
1	Ridgetop
2	Sidehill
3	Canyon bottom and draw
4	Dry flat
5	Wet flat
6	Other

(13) Type. Each plot is typed according to the species of timber present. Timber type codes are:

Code	Type	Remarks
01	Pine	50% or more pine
02	Redwood	50% or more Redwood
03	Douglas-fir	50% or more Douglas-fir
04	Fir	50% or more fir
05	Mixed Conifer (Pine-Douglas-fir-Fir)	All species with less than 50%
06	Lodgepole-Mt.Hemlock	50% or more of either species
07	Juniper-pinyon, etc.	

(14) Stand Size Class. Stand size class is a means of classifying forest lands based on the predominant size of timber present--that is old or young sawtimber. In order to be classified as "cut" at least 10 percent of the volume must be removed. The dividing line between old growth and young growth is 150 years. Sawtimber includes trees 11.0 inches DBH and over. Codes used for stand size classes are:

Code	Size Classes
0	Old growth sawtimber - uncut
1	Old growth sawtimber - cut
2	Young growth sawtimber - uncut
3	Young growth sawtimber - cut

(15) Stand Treatment. This refers to the condition of the timber stand at the time the plot is taken--that is whether virgin, cut or partial cut and the age and degree of cuttings. Codes and descriptions are:

Code	Description
1	Virgin
2	Recent partial cut (less than 50%)
3	Old partial cut (less than 50%)
4	Recent partial cut (more than 50%)

Code	Description
5	Old partial cut (more than 50%)
6	Recent clear cut
7	Old clear cut

(16) Density. This is an expression in percent of the stocking on the ground or total ground cover of trees. Density is expressed with two digits--the first used for sawtimber (trees over 11 inches DBH) and the second including all timber. As an example: The sawtimber is estimated at 50 percent (code 2) and the area between the larger trees is stocked well enough to bring the total up to 90 percent (code 1). The code for this particular density or stocking would be 21. Codes and descriptions for density are:

Code	Description
11	Well stocked (70-100 percent)
22	Medium stocked (40-69 percent)
33	Poorly stocked (10-39 percent)
66	Nonstocked (0-9 percent)

c. Tree Data

(17) Tree Number. Three-digit numbers are used for numbering trees, beginning with 001 and continuing to 030 if five broadleaf trees are found on the plot. (For pole plots as many numbers are used as there are poled.) The first broadleaf tree found on the plot is always number 026, even though it is the first tree examined on the plot, and only the first five broadleaf trees are examined regardless of the number which occur on the plot. When a forked tree is encountered (either broadleaf or conifer) with crotch low enough to permit measuring of both stems, each is counted as a tree if it is over 11 inches DBH.

(18) Tree Species. All trees are recorded by their respective species code which is a two-digit number. Codes for trees that might be found in California are:

Coniferous Species

Code	Species	Code	Species
	Douglas-fir		Major Pines
01	Douglas-fir	11	Ponderosa
02	Bigcone Douglas-fir	12	Jeffrey
		13	Sugar
	Sequoia	14	Western white
		15	Lodgepole
05	Redwood		
06	Giant Sequoia		

Code	Species
	Minor Pines
21	Coulter
22	Monterey
23	Digger
24	Knobcone
25	Bishop
25	Torrey
26	Apache
26	Bristlecone, Foxtail, Limber & Whitebark
27	Pinyon (also Mexican, Perry, Singleleaf)
	True Firs
31	White
32	California Red
33	Grand
37	Bristlecone
	Spruce
41	Engelmann
42	Sitka
46	Brewer
	Hemlock
47	Mountain
48	Western
	Cedar
51	Incense
53	Port Orford
54	Western Red Cedar
	Other Conifers
61	California Torreya
62	Pacific Yew
63	Juniper (all Juniperus spp.)
64	Cypress (all Cupressus spp.)
	Broadleaf Species
71	Alder (all Alnus spp.)
72	Ash (all Fraxinus spp.)
73	Aspen (Quaking)
74	Birch (all Betula spp.)
75	Cottonwood (all Populus spp. except P. tremuloides)
76	Maple (all Acer spp.)
77	Willow (all Salix spp.)
	Oaks
81	California Black
82	California Live
83	California White
84	Canyon Live
85	Interior Live
86	Oregon White
87	Tanoak
88	Other Oaks

Other Broadleaf Trees

Code	Description
91	California Laurel
92	Cascara Buckthorn
93	Golden Chinkapin
94	Madrone
95	Dogwood
96	Sycamore (all Platinus spp.)
98	Other hardwoods

(19) Diameter (DBH). Each tree on the plot will be measured with a diameter tape to the nearest 1/10 inch. Measurement will be at breast height (4.5 feet from ground level) on the uphill

side of the tree. The tape must be kept at a right angle to the axis of the bole (for most trees this means the tape will be in a horizontal position). For large trees on steep slopes the tape may have to be elevated with a forked stick to keep it in a horizontal position as it is unwound around the tree. A four-digit figure will be used for recording diameters--a tree 22.6 inches DBH will be recorded 0226 and one 108.3 inches DBH will be recorded 1083.

(20) Dunning Tree Classes. All conifers except redwood are to be classified by the Dunning tree classification (illustrated and described in the Appendix page A-6). A one-digit number will be used to record Dunning's tree classes--the codes for which are:

Code	DC*	Description
1	1	60-150 years Dominant
2	2	60-150 years Codominant
3	3	150-300 years Dominant
4	4	150-300 years Codominant
5	5	Over 300 years
6	6	60-150 years Int. to Supp.
7	7	Over 150 years Int. to Supp.
8	5A	Over 300 years Thrifty
9	Redwoods and Hardwoods	

(21) Keen Tree Classes. All conifers are to be rated by the Keen tree classes. Keen expanded Dunning's classification by using age, crown size, and dominance (see Appendix page A-7). A two-digit number is used to express Keen's tree classes--the first digit representing age and the second crown-vigor. Codes for Keen's tree classes are:

Code	KC**	Description
	0 - 80 years	
11	1A	Young Dominant
12	1B	Young Codominant
13	1C	Young Intermediate
14	1D	Young Suppressed
	80 - 180 years	
21	2A	Immature Dominant
22	2B	Immature Codominant
23	2C	Immature Intermediate
24	2D	Immature Suppressed

---

* Dunning tree class
** Keen classification

Code	KC**	Description
	180 - 300 years	
31	3A	Mature Dominant
32	3B	Mature Codominant
33	3C	Mature Intermediate
34	3D	Mature Suppressed
	Over 300 years	
41	4A	Overmature Dominant
42	4B	Overmature Codominant
43	4C	Overmature Intermediate
44	4D	Overmature Suppressed
99	Hardwoods	

(22) Risk Classes. Risk classes are required in the regional timber management procedures (classes and codes are described in the Appendix page A-9). Each tree is examined, its risk determined, and a one-digit number used to record classes as follows:

Code	Description
1	Good risk trees (Salmon-Bongberg Classes 1 and 2)
2	Poor risk trees, no reason evident
3	Poor risk trees due to insects (Salmon-Bongberg Classes 3 and 4)
4	Poor risk trees due to mechanical reasons
5	Poor risk trees due to disease
9	Hardwoods or broadleaf trees

(23) Merchantability Classes. Merchantability class indicates the present or potential commercial condition of a tree. To be considered merchantable a coniferous timber tree must contain 25 percent or more of its gross board foot volume in sound material. Trees containing less than 25 percent net volume in board feet will be classed as rotten culls. Broadleaf trees must contain 40 percent or more sound material in board feet to be classed as merchantable. Trees that are sound but because of roughness, poor form, or that for any other reason do not contain at least one 16-foot merchantable sawlog are classified as sound cull. A one-digit number is used to record merchantability classes. The codes and descriptions for these are:

Merchantability Classes

Code	Description
0	Too small to be merchantable (short trees on poor sites less than 16 inches DBH)

** Keen classification

Code	Description
1	Merchantable tree (at least one 16-foot log or 25% sound)
2	Sound cull tree (crooked, etc.)
3	Rotten cull tree (less than 25% sound material for conifers and less than 40% sound material for broadleaf trees)

d. Pathological Data

The codes and descriptions for the next 3 sections (Injury, Bole Wounds, and Abnormal Growth) apply to both sawtimber and poles.

(24) Injury. Injury includes more or less accumulative types of damage not listed under Bole Wounds. Injuries, especially when moderate to severe are often portals of entry for wood rotting fungi and pathogens. Proper deductions are made for cull where the cull factor tables apply. These are described in the Appendix page A-22). Injury is recorded with a two-digit number, the first digit giving the type of injury and the second showing the intensity of severity of the injury. Intensity is the degree of injury and often depends on the location of the wound. For example, a broken top extending well into the merchantable portion of the bole would be severe; one that only reaches it would be moderate; and a break occurring only a few feet below the top would be slight. Both the columns for kind and intensity of injury have two spaces for two digits each. The first digit is for one injury and the second for another in the kind column. The same applies to the intensity column. For example, a frost crack and a broken top would be recorded as 14 in the kind column. If the frost crack was recent-slight and the broken top old-moderate, 15 would be recorded in the intensity column. Codes and descriptions of injuries and their intensities follow:

Injury		Intensity	
Code	Description	Code	Description
0	None	0	None
1	Frost crack	1	Slight-recent
2	Crook from injury	2	Moderate-recent
3	Dead top	3	Severe-recent
4	Broken top	4	Slight-old
5	Snow damage	5	Moderate-old
6	Leaning tree	6	Severe-old
7	Sapsucker work	7	
8		8	
9	Unclassified	9	

(25) Bole Wounds. This type of injury generally includes those made by a single wounding such as lightning. In all but

insect injury the bark is torn or burned away in various degrees and offers an excellent portal for pathogens and wood rotting fungi. The intensity rating of wounds, like injury, depends upon the location and size of the damaged area. A fallen tree scar (one tree falls against the trunk of another tree and slides down it) consisting of intermittent torn bark and exposed wood is more serious than if the same amount of torn bark was combined in one wound. Because two-digit numbers are used in both the kind and intensity columns, two wounds and their respective intensities can be recorded. For example, a fire scar (old-severe) and porcupine damage (recent-moderate) would be recorded 15 for kind and 62 for intensity. Codes and descriptions for types of bole wounds and their intensities are:

Wounds		Intensities	
Code	Description	Code	Description
0	None	0	None
1	Fire scar	1	Slight-recent
2	Lightning	2	Moderate-recent
3	Falling tree	3	Severe-recent
4	Logging	4	Slight-old
5	Porcupine	5	Moderate-old
6	Insects	6	Severe-old
7	Bear	7	
8	Squirrel	8	
9	Unclassified	9	

(26) Abnormal Growth. Abnormal growths frequently are caused by minor injuries occurring when the tree was young. These may take various forms depending on the type and cause of injury. Most are rated on size, but sweep more or less depends upon degree as well as length of the curve in the bole. If a fork occurs low enough to permit measuring of both stems, each should be counted as a separate tree. A two-digit number is used to designate abnormal growth allowing two deformities and their respective intensities to be recorded for any one tree. Codes and descriptions of abnormal growth and their respective sizes are:

Abnormal Growth		Sizes	
Code	Description	Code	Description
0	None	0	None
1	Fork	1	Small-live
2	Burl (other than dwarfmistletoe)	2	Medium-live
3	Basal shoot	3	Large-live
4	Sucker limb	4	Small-dead
5	Bayonet top	5	Medium-dead
6	Retained dead top	6	Large-dead
7	Sweep	7	
8		8	
9	Unclassified	9	

(27) Percent Cull in Board Feet. That part of a living tree not merchantable because of defect is termed cull. The defect may be a result of decayed wood, shake, fire scars or poor form. The percent of cull (if any) for each tree examined will be determined and recorded using the common cull indicators such as conks, swollen knots, fire scars, logging and fallen tree scars, dead tops, broken tops, mistletoe cankers, etc. For pine species each tree will be judged on symptoms and visible damage, but for Douglas-fir, red and white fir, redwood and incense-cedar the proper cull factors prepared by J. W. Kimmey* will be used. The percentages of cull for the various indicators or combinations of indicators for each site class are listed in table form and are to be used for these five tree species (See Appendix pages A-22 to A-27).

For cull purposes bole wounds caused by frost cracks, porcupine, falling trees, etc., will deduct the same amount of cull as a fire scar of the same size and age. When deducting for old wounds, fire scars, etc., the full amount of cull will be used for those scars rated as being of severe intensity. Scars determined as being of moderate intensity will have two-thirds of the total allowable cull deducted. Scars rated as being of light intensity will have one third of the allowable cull deducted. Scars less than 50 years old will be judged individually and unless there is visible evidence of cull being present no deduction will be made. Wounds 15 feet or more above the ground and 10 feet below the merchantable top will be allowed 1/4 more cull than a similar fire scar at ground level. For example, if a cull of 56 percent is indicated for a given wound (18" DBH Douglas-fir, old fire scar, Site 3) and the wound is 25 feet from the ground, 1/4 of 56 or 14 percent more is added, giving a total of 70 percent cull.

Incense-cedar is probably the most defective conifer in California and there is considerable variation in amount of cull between stands, especially stands in different subregions. Although there is a large amount of cull in this tree species, caused by the pocket dry rot, Polyporus amarus, indications of decay are generally absent. Since there are no satisfactory cull indicators on standing trees, flat cull factors are considered the most reliable method of indicating cull. A relatively small amount of incense-cedar occurs in the typical eastside forest, and it was found to be freer of rot than trees west of the crest. For eastside incense-cedar on dry east slopes cull factors equal to one-half the values given in the incense-cedar cull factor table should be used. A complete description of cull indicators--as well as cull factor tables giving percentage of cull in board feet to be deducted for the various defects--will be found in the Appendix page A-24. A two-digit number is used for recording cull and the actual percentage from 01 to 99 is entered.

* California Forest & Range Experiment Station - Berkeley, California.
Forest Survey Release No. 7, June 1, 1950
Forest Survey Release No. 13, May, 1952
Forest Research Notes No. 90, April 1, 1954

(28) Heart Rot. The bole and base of each tree will be examined carefully for fruiting structures of heart rots. Eight heart rots are coded here and others can be recorded under Miscellaneous Diseases. Unknown heart rots will be recorded as unclassified, and if later identified should be recorded (in code) in the proper place on the data sheet. The intensity of heart rot already has been recorded as percent of cull. The intensity column on the data sheet will be used to record a second heart rot if two occur in the same tree. Codes for the various heart rots are:

Codes		Description
0	0	None
1	1	Fomes pini
2	2	Echinodontium tinctorium
3	3	Fomes officinalis
4	4	Pholiota adiposa
5	5	Polyporus amarus
6	6	Armillaria mellea
7	7	Lentinus lepideus
8	8	Polyporus schweinitzii
9	9	Unclassified

(29) Dwarfmistletoes. Dwarfmistletoes, Arceuthobium spp. are confined to certain conifers and cause extensive damage in western forests, ranking next to heart rots in losses produced. In general they reduce the vigor and rate of growth of their hosts so that infected stands require a longer time to reach maturity and even then often produce a lower quality timber. Dwarfmistletoe is rather difficult to find unless the parasite has been present long enough to develop conspicuous swellings on the twigs, witches' brooms in the limbs, or burls or cankers in the bole. This is particularly true of dwarfmistletoe in Douglas-fir as the shoots are generally less than an inch in length. Also, dwarfmistletoe is more difficult to see in the winter and spring than it is in the summer and early fall because many of the shoots die each fall and many others are knocked off by the wind and snow. In cases where old mistletoe brooms (now dead but verified from mistletoe cups) are found but no living dwarfmistletoe shoots can be seen, it will be assumed that the tree still supports a light infection.

Dwarfmistletoe that has reached the bole is recorded in three ways--depending on the length of time present or stage of damage developed. Infections that have just started on the bole or that have just reached the bole from an infected limb are referred to as "bole infections." When the mistletoe has been present long enough to form burls or to cause malformation of the stem, but not long enough to kill the bark and expose the wood, it is referred to as a dwarfmistletoe burl. When the parasite has been present long enough to kill a portion of the bark and expose the wood of the trunk it is referred to as a dwarfmistletoe canker. When such a canker occurs in Douglas-fir,

red fir or white fir, the cull factor applicable to a similar sized fire scar of the same age is used. Care must be taken to differentiate between witches' brooms on red and white firs caused by dwarfmistletoe and those caused by yellow witches' broom (Melampsorella caryophyllacearum). Care also must be taken to differentiate between brooms caused by Elytroderma needle blight and those caused by dwarfmistletoe on Jeffrey, ponderosa, lodgepole, and knobcone pine. This is especially true for the first two pines.

In judging the intensity of dwarfmistletoe infection on the limbs the living crown is divided into three parts, (upper, middle and lower) and each portion judged individually as 0, 1, 2 or 3. An "0" means there is no infection--1 that at least one plant is present and from that up to 1/3 of the limbs and twigs in that portion of the crown are infected. A rating of 2 means over 1/3 but less than 2/3 of the limbs and twigs in that portion of the crown are infected, while a 3 means that over 2/3 of the limbs and twigs in that portion of the crown are infected with the parasite.

After all three portions of the crown have been examined and rated ratings are added for total intensity. For example, if a rating of 3 is given to the lower crown, 2 to the middle crown, and 1 to the upper crown, an intensity of 6 is recorded for limbs (in the intensity column on the data sheet). Under "kind" of infection the various combinations of infection (such as branch only, bole only, branch and 1 burl, etc.,) are recorded. A one-digit number is used to record dwarfmistletoe infections, with codes for kinds and intensity as follows:

Code	Kind	Intensity of limb infection		
0	None	0	None	
1	Branch infection only	1		Light
2	Bole infection only	2		
3	Branch and 1 Burl	3		
4	Branch and 1 + Burl	4		
5	Branch and 1 canker	5		Medium
6	Branch and 1 + canker	6		
7	Branch, burl and canker	7		Heavy
8	Branch and bole (but no burls or cankers)	8		Very Heavy
9		9		

Heavy dwarfmistletoe infection has a marked influence on the risk rating given a tree. Trees having a limb intensity of 7 or over are definitely a high risk. Those supporting cankers have to be

judged on the size of the canker along with any limb infection. Trees with a limb rating of 6 or over and a small canker (small in relation to the size of the tree) or two or more burls also will have a high risk rating (code 5 in the Risk Class).

(30) Foliage Diseases. Foliage diseases include the needle casts and others as well as some of the troublesome limb cankers such as Cytospora canker of red and white fir. Cankers other than Cytospora (which is coded separately) will be recorded under the codes listed for Miscellaneous Diseases. Other needle casts and diseases also will be recorded under these codes.

The intensity of the foliage disease will be judged by crown-thirds (upper, middle, and lower, as described for dwarfmistletoe) and the sums of these are to be added to give the final code number. For example, if the upper crown has an intensity of Elytroderma deformans of 2, the middle crown 2 and the lower crown 1, these are added and a code of 5 recorded. Rarely does more than one needle cast occur on a tree at the same time but when it does it usually can be handled under Miscellaneous Diseases. Samples of unknown needle diseases or cankers should be collected for later identification. A one-digit number is used to record foliage diseases--codes, descriptions and their intensities are:

Code	Description	Code for Intensity of Infection	
0	None	0	None
1	Elytroderma deformans	1	Light
2	Hypodermella medusa	2	
3	Blue brooms	3	
4	Hypoderma robustum	4	Medium
5	Hypodermella abietis-concoloris	5	
6	Branch canker (unknown)	6	Heavy
7	Cytospora abietis	7	
8	Rhabdocline pseudotsugae	8	Very Heavy
9	Unclassified (foliage disease)	9	

Occasionally foliage diseases or limb cankers affect the risk rating assigned to a tree. A heavy infection of Elytroderma needle blight that has reached the brooming stage (an intensity of 7 to 9 made up of brooms) or a heavy infection of Cytospora canker with the same intensity rating would cause a tree to be assigned a poor risk rating (code 5 in Risk Class).

(31) Rusts. The rusts considered in this section are those causing twig, limb, and bole damage. Needle rusts would be recorded under foliage diseases. In most cases symptoms or indicators of each species of rust appear differently on the coniferous host. The presence of rusts are hard to detect when only a light infection is present and especially after the seasonal sporulating stage has passed. Occasionally two of the rusts, Peridermium stalactiforme and P. filamentosum are difficult to distinguish one from the other when found on Jeffrey pine. This is particularly true if the rust has not been present long enough to assume its characteristic pattern of limb killing in the crown. When rust is found on the various alternate hosts a footnote should be made at the bottom of the data sheet reporting host species, abundance and (if possible) species of rust. The intensity of the rust is coded the same as intensity for both dwarfmistletoe and foliage diseases. Each portion of the crown (upper, middle and lower) is rated separately and the sum of the three added to give the final code rating. The risk class assigned to a tree in the white pine group frequently is influenced by a heavy infection of Cronartium ribicola. Twigs, limbs, and bole should be examined carefully for symptoms of the rust that occurs on the particular species of tree being inspected. A one-digit number is used to record rusts--the codes, descriptions, and their intensities are as follows:

Code	Description	Code for Intensity of Infection	
0	None	0	None
1	Peridermium harknessi	1	Light
2	Peridermium stalactiforme	2	
3	Peridermium filamentosum	3	
4	Cronartium comandrae	4	Medium
5	Cronartium ribicola	5	
6	Gymnosporangium libocedri	6	Heavy
7	Melampsorella caryophyllacearum	7	
8		8	Very Heavy
9	Unclassified	9	

(32) Root Diseases. Root diseases as a group are probably the most difficult tree ailment to detect and recognize because the part of the tree affected is usually under ground and out of sight. The crown symptoms of many root diseases are indistinguishable from those caused by physiological disorders. Generally the young roots are killed and new root production is inhibited until

the tree's vigor is severely reduced. In some cases the tree is killed. In addition extensive decay or killing of a tree's roots predisposes it to windthrow.

A few seed plants are parasitic on the roots of trees, but the effects of these parasites are unknown. However, observations indicate that the damage from this type of parasite to coniferous roots is insignificant.

There are a great many soil fungi--some pathogenic, some weakly parasitic on weakened root systems, and at the other end of the scale beneficial ones of the mycorrhizal group. These, along with diseases caused by bacteria, can be isolated and identified only in the laboratory. When trees are encountered that are definitely in a weakened or dying condition, root samples should be collected (if possible) and submitted for cultural tests. When diseased root samples are collected a note should be made on the data sheet to this effect and the sample referenced to the plot number in its descriptive data. Trees recently blown over exposing their roots (seen in the vicinity of a plot) should be examined for root diseases. A one-digit number is used to record root diseases--the codes, descriptions and intensities are as follows:

Code	Description		Intensity
0	None	0	None
1	Polyporus schweinitzii	1	Tree weakened
2	Armillaria mellea	2	Tree dying
3	Fomes annosus		
4	Verticicladiella wagenerii		
5	Poria weirii		
6			
7			
8			
9	Unclassified		

(33) Noninfectious or Physiological Diseases. Physiological diseases are noninfectious or nonparasitic diseases. These can be caused by high temperatures, low temperatures, drought conditions or moisture deficiency, excess moisture or flooding, frost either late spring or early fall, winter injury (a combination of freezing with either hot sunshine or high wind) nutritional deficiency or excess minerals, smoke injury and smelter fumes, chemical damage (either from foliage spray or root absorption) salt spray, hail, ice and snow. Usually physiological diseases are of a temporary nature and if the trees are not too severely injured they soon recover. Since this group of diseases varies so widely only a broad set of intensity ratings can be used. A one-digit code number records noninfectious diseases and their intensities as follows:

Code	Description	Code of Intensities	
0	None	0	None
1	Suppression	1	Light
2	Drought	2	Medium
3	Cold injury	3	Heavy
4	Heat injury	4	Killing tree
5	Flooding		
6	Red Belt		
7	Cork bark		
8	Sunscald		
9	Unclassified		

Other known physiological diseases can be recorded under Miscellaneous Diseases.

(34) True Mistletoes. Certain conifers (incense-cedar, junipers, and cypresses as well as white fir south of Placer County) and all broadleaf trees on the plot should be examined carefully for true mistletoes. Care must be exercised with incense-cedar to differentiate between clumps of mistletoe and the compact brooms caused by Gymnosporangium libocedri the incense-cedar rust. True mistletoe in white fir frequently occurs only in the top of the tree and a strong majority of the mistletoe plants in incense-cedar and white fir occur in the upper third of the living crown. True mistletoes in time kills many of the limbs on which it grows and frequently kills the top of an incense-cedar or white fir but rarely is the whole tree killed by this parasite. The intensity of infection of true mistletoe is rated from 1 to 9 with each 1/3 of the crown having a possible rating of 3. The code and description follow:

Code	Description		Intensity of Limb Infection
0	None	0	None
1	Branch infection only	1	
2	Branch and bole infection	2	
		3	
		4	
		5	
		6	
		7	
		8	
		9	

(35) Miscellaneous Diseases. This classification permits coding of data for diseases of lesser importance, as well as for those of infrequent occurrence. Two separate diseases, in addition to those listed under the other headings, can be recorded for any one tree. Since these diseases are of lesser importance, no provision has been made for intensity ratings. Two-digit numbers will be used for each of the two diseases. The codes for these are:

Foliage Diseases		Hosts
01	Lophodermium pinicolum	Hard pines
02	Lophodermina nitens	White pines
03	Lophodermina autumnalis	White and red firs
04	Hypodermella puncata	Red fir
05	Hypodermella montana	Lodgepole pine
06	Hypodermella montivaga	Lodgepole pine
07	Hypodermella arcuata	Sugar pine
08	Hypoderma pini	Pinyon pine
09		
10		
11	Phacidium infestans var. abietis	White fir
12	Naemacyclus nivens	Most pines
13	Stigmatea sequoiae	Incense-cedar and juniper
14	Leptothyrium spp.	Incense-cedar
15	Leptothyrium pseudotsugae	Douglas-fir
16	Adelopus gaeumanni	Douglas-fir
17	Coryneum cinereum	Ponderosa, Jeffrey, lodgepole, sugar pines
18	Cenangium spp.	White fir
19	Mycosphaerella sequoiae	Redwood
20		
21		
22		
23		
24		
25		
26	Herpotrichia nigra	Conifers, other than pines
27	Neopeckia coulteri	On pines
28		
29		
30	Unclassified	

Heart Rots		
31	Poria sequoiae	Redwood
32	Poria albipellucida	Redwood
33		
40	Unclassified	

Cankers		
41	Phomopsis lokoyae	Douglas-fir
42		
43		
50	Unclassified	

Root Diseases		
51		
52		
60	Unclassified	

If no data are taken for a given column on the data sheet, a line should be drawn through that section of the form to indicate that the item has not been overlooked. Also, this often prevents one tree's data from being entered in another tree's column. See sample data sheet in Appendix page A-28.

2. Pole Plots (Coniferous Trees from 5 to 10.9 Inches DBH)

The general headings for the pole-data sheet are fewer in number than those for merchantable trees, but the codes for the headings that are present are the same for both forms. The plot name always should be entered (in its proper place) because the township, range, and section do not appear on this form. Under "Tree Data" in the body of the form the first 3 columns will be the same as for the larger trees. Pole sized trees generally are too young to be recorded by Dunning tree classes. If the pole is under 60 years old a zero is used in this column. The next two columns (Keen class and risk class) are handled on this form as on the one for larger trees. Under "Pathological Data" all the columns will be handled as described for the larger trees.

It must be remembered that the pole plot is always 1/2-chain-wide and 2 chains long. It always starts at the exact end of the merchantable timber plot and retraces the last two chains of that plot. If no trees 5 to 10.9 inches in diameter (at breast height) are on the plot write in on the form "no trees on plot." Broadleaf trees are not considered when taking a pole plot.

3. Seedling and Sapling Plots (Established Coniferous Trees up to 4.9 Inches DBH)

The size of this plot is 1/2 chain by 1/2 chain. It starts at the exact spot where the pole plot ends and covers the last 1/2 chain of the pole plot. The sheet headings for the seedling and sapling plot are the same as those for the pole plot.

The trees are tallied by species by seven different size classes. Species codes are the same as those used for merchantable timber and for poles. Size classes for seedlings and saplings, their codes and description are:

Code	Description
1	1 year old to 0.5 foot high
2	0.6' to 4.5' high
3	4.6' high to 0.9 inch diameter breast height
4	1.0" to 1.9" DBH
5	2.0" to 2.9" DBH
6	3.0" to 3.9" DBH
7	4.0" to 4.9" DBH

It is best to divide the plot into halves before looking for the seedlings and saplings. If there are many trees present the trees below 0.6" high should be searched for separately. Care must be used in thickets to be sure all trees on the plot are counted and to be sure that no "off plot" trees are included.

In calling the seedlings to the recorder the species code always should be called first so the recorder will be on the proper line. Then the size class is called and finally the number of trees if there are more than one. For example, a clump of 2-foot-high white fir (10 trees) and incense-cedar (3 trees) is encountered. After counting the white fir the examiner would call off "Thirty one," "Two," "Ten times" and "Fifty-one," "two," "Three times." Each tree is tallied in the proper column and when the plot is completed the trees are added and the total of each size class recorded in its proper place under "No. of trees." A 3-digit number is used to record the number of trees.

a. Injury. When rating the seedlings and saplings only one injury per tree species can be considered. If more than one type of damage is present the one affecting the greatest number of trees is the one to be used. If the cause of the injury is unknown it should be recorded as "unclassified code 99." The intensity of injury also is recorded with a 2-digit number. The first digit denotes the percent of trees (within a given size class) that are affected while the second gives the degree of damage to the affected trees or the range of damage, whichever applies. The code and kinds of injury are:

Code	Description	Code	Description
00	None	10	Rodent
01	Fire	11	Porcupine
02	Snow	12	
02	Frost	13	
04	Logging	14	
05	Christmas tree cut	15	
06	Falling tree	16	
07	Fork	17	
08	Broken top	18	
09	Browse	99	Unclassified

Intensity codes and descriptions for seedlings and saplings are to be used for both injury and disease. They are as follows:

First digit code	Percent of size class affected	Second digit code	Degree of damage to affected tree
0	None	0	None
1	1-10	1	Slight
2	11-20	2	Moderate
3	21-30	3	Severe
4	31-40	4	Slight to Moderate
5	41-50	5	Slight to Severe
6	51-60	6	Moderate to Severe
7	61-70	7	Killing trees
8	71-80	8	
9	81-100	9	

b. Disease. Diseases are handled in the same manner as injury. Only one disease per tree species can be recorded and if more than one is present the one involving the greatest number of trees should be recorded. If a second disease is present--and has not already been recorded either on a plot tree or as an off-plot tree for merchantable timber or poles--it should be so recorded (on the merchantable timber data sheet). Also record the second disease in the "notes" column on the seedling and sapling sheet. A two-digit number is used to record various diseases that might be present on the coniferous seedlings and saplings--codes below:

The codes for the various disease are:

All Diseases

00 None

Root Diseases (01-15)

01 Polyporus schweinitzii
02 Armillaria mellea
03 Fomes annosus
04 Verticicladiella spp.
05
06
07
15 Unclassified

Rusts (16-30)

16 Peridermium harknessii
17 Peridermium stalactiforme
18 Peridermium filamentosum
19 Cronartium comandrae
20 Cronartium ribicola
21 Gymnosporangium libocedri
22 Melampsorella caryophyllacearum
23
30 Unclassified

Foliage Diseases (31-45)

31 Elytroderma deformans
32 Hypodermella medusa
33 Hypodermella abietis-concoloris
34 Hypodermella montana
35 Hypoderma robustum
36 Snow Mold
45 Unclassified
46 Dwarfmistletoe
47 True Mistletoe

Physiological Diseases (48-65)

48 Suppression
49 Drought
50 Cold injury
51 Heat injury
52 Flooding
53 Red belt
54
65 Unclassified

Miscellaneous Diseases and Heart Rots (66-80)

66 Fomes pini
67
80 Unclassified
98 Insects
99 Unclassified Diseases

If no trees from current year seedlings to 4.9 inches in diameter (at breast height) are on the plot write in on the form "no trees on plot." Broadleaf trees are not considered when taking a seedling and sapling plot.

F. GENERAL INFORMATION

1. Care of Completed Data Sheets

As soon as the plot has been completed data sheets should be stapled together and filed in the proper envelope--and the plot number and other information should be transferred to the draw sheet. The green plastic dot representing the plot just examined also should be transferred from the map to the draw sheet. If data are taken on the plot the tag is stuck in the reject column opposite the plot number while if the plot is rejected the plastic dot is placed in the Plot No. column instead of a number. This gives a quick check on the status of all plots. All completed forms should be left in the San Francisco Office at the first opportunity.

2. Disease Samples

Note collection of disease sample when made (heart rots, needle diseases, limb cankers or infection, etc.,) on the plot so that later the determination can be recorded in its proper place. For example, if a sample of heart rot is collected from red fir and later is identified as Echinodontium tinctorium this record should be transferred from the unknown classification code 9 to its proper class code 2. On the other hand, if the sample is identified positively but has no code under heart rots it can be recorded under Miscellaneous Diseases.

3. Disposition of Plot Irregularities

Plots are moved to the nearest road on the map, but in many cases the road leading to it is blocked by a fallen tree, a wash out, a slide, or from other causes. The plot should be taken on the navigable road nearest to the "initial point." Frequently the point at the "road block" is still the nearest to the plot but sometimes an entirely different road may have the nearest point.

When plots cross dangerous areas (cliffs, pumice slopes as those high on Mt. Shasta, etc.,) off-set around the danger area, if this is possible, and continue with the strip. If an off-set will not solve the problem the plot should be rejected. Do not take chances on steep slopes or dangerous ground--remember a $40 plot isn't worth endangering a $50,000 neck.

When a road follows a river (the river such as the Klamath being too wide and too deep to wade) and the plot falls across the river from the road and in good timber, it should be moved to the next nearest road in the same subregion.

When a plot falls in a thickly populated area (many ownerships involved) it should be rejected due to influence of construction and intensive use.

4. Off-Plot Diseases

From the time the car is stopped at the "reference point" on the road both survey men should be looking for diseases of any kind occurring

on off-plot conifers in the vicinity of the plot. Vicinity for this purpose has been defined as being within 1/4 mile of the reference point. When the plot has been completed, diseases noted in the area but not found on the plot trees should be recorded in tree lines numbered 031 to 036 at the bottom of the data sheet. If a disease occurs on a plot tree (for example Hypoderma robustum on white fir) and is found off plot on a different host (red fir) both the disease and its different host should be recorded under "Diseases on Off-Plot Conifers." Under "Tree Data" complete only the species column and under "Pathological Data" only the proper columns for heart rots and diseases. Record miscellaneous diseases with their proper code under the column numbered 35. In addition to the diseases that can be recorded under the normal codes two extra diseases can be recorded here for any one tree.

5. Length of Plot Strip

The length of strip covered when taking data on a plot should be recorded in chains to the nearest pace. For example, if the length of pace used is 12 per chain and 115 paces are traveled in securing the 25 trees it should be recorded as 9-7/12 chains.

6. Care of Equipment

a. Survey Equipment. Since some of the survey equipment is rather delicate it should be handled with the degree of care needed to keep it in good working condition.

b. Increment Borer. Care should be taken to avoid damage to the threads and cutting bit of the increment borer. If these are nicked or dulled the tool will not produce a clean, smooth cut core. The extractor and tube of the borer should be cleaned each night with a solvent to remove pitch and dirt. Prepare tiny cloth cleaning patches, which can be pushed through the tube of the borer with the extractor, just as in cleaning a rifle. After cleaning, lubricate with a light film of oil. Do not force the borer into the tree (defective, especially pitchy, etc.) as it can be easily broken. It would be better to determine the age by other means or by estimation rather than risk snapping the boring tube. As soon as the tree has been bored to the desired depth, unscrew the tube one complete turn, extract the core and remove the bit immediately (without waiting to count the rings) to prevent the tube from "freezing" in the tree. Always hang the extractor on the bark of the tree being bored so it won't be stepped on while securing the tree's age.

c. Abney Hand Level. The Abney should be kept clean (especially the mirror) to give a clear view of the level bubble. Avoid dropping or other rough treatment. The instrument should be checked occasionally to be sure it is still in adjustment.

d. Compass. The Silva Ranger compass (liquid filled) is recommended for this work as the bearing can be set off for any azimuth with a "twist of the dial." Although this is a fairly rugged compass it should be handled with care. Do not lay it near a source of heat or where

temperature can become extreme (such as on a rock in the sun) as the expanding liquid may damage the capsule. When other type compasses are used the needle should be kept in a raised position except when in use to avoid damaging the pivot point.

e. Tally Register. Care should be taken to avoid dropping or immersing in water. Be sure the ring is tight. When using, turn dial to zero and be sure the dial-setting button returns to the lock position.

f. Hand Axe. Always use sheath when carrying. Keep sharp and use only for its intended purpose. If the axe has a wooden handle be sure the head is tight on the handle.

g. Binoculars. Keep glasses in their case when not in use. When taking a plot carry the binoculars by the strap placed around the neck. Blow the dust and pollen from the eye pieces each time before putting them to the eyes, and keep the lenses clean by using lenspaper or a soft clean cloth.

h. Diameter Tape. The diameter tape should be cleaned and oiled at frequent intervals. Extreme care must be taken to avoid kinks and breakage. The tape should be completely wound immediately following a measurement--tight enough to hold the hook securely in the groove to avoid injury to the user.

i. Other Field Equipment. Field men will be expected to exercise reasonable care with all items of equipment to prevent damage or loss.

j. Automotive Equipment. An effort should be made to service the automobile as near its mileage requirement as possible--without driving extra miles for that specific purpose (most of the service requirements are posted on the dash). Any necessary repairs and replacements should be made as soon as possible so that the automobile will give the best and most efficient service. The car's equipment should be checked at intervals for condition and completeness--a well-serviced and maintained vehicle is a safe means of transportation.

7. Crew Duties

a. Pathologist. The pathologist will be in charge of the disease crew and together with the recorder will plan each day's work. He will examine the map carefully and determine the best route to the first plot to be examined each day and the shortest route and quickest time from plot to plot.

He will determine an orientation point (a point recognizable on both the ground and map) from which the mileage to the "reference point" can be estimated. He also will act as navigator to be sure the right road is traveled and that the proper distance is traversed from the orientation point so that the reference point can be located.

The pathologist will select a site tree and measure the DBH and height while the tree is being bored. He then will determine the age while the increment bit is being extracted. The pathologist will measure the diameter of each tree encountered on the plot strip and will start calling data as to tree class, risk class, etc. Next he will examine the tree for injuries, wounds, abnormal growth, hear rots, and the various types of diseases including noninfectious ones. When anything is found that is to be recorded he will call the information to the recorder.

When the plot is completed the pathologist will call any off-plot diseases that he has observed. He then will check the data sheets to see that all the information necessary has been entered. When unknown heart rots or general diseases are encountered, samples are collected (and later sent in for determination) and the necessary notes taken.

b. Recorder. The recorder will complete as many of the headings on the various data sheets as he can before leaving the vehicle. He then uses the increment borer to obtain a core for age determination.

A recorder uses a compass to follow the azimuth and paces to determine the distance traveled. He drags a heavy cord about one-half chain in length which provides a definite center line from which to measure strip width when a tree's position is in question (whether it is on or off strip). He records the data in code called by the pathologist. The recorder also watches for off-strip diseases not occurring on the plot trees. He applies cull factors to those tree species requiring the use of a flat cull factor for wounds and injuries. At the end of the day the recorder places the completed sheets in the file envelope and replaces them with fresh sheets for the next set of plots. He cleans the increment borer (if needed) and checks all the equipment to be sure it is all present before leaving the plot site. The recorder will do most of the driving in the field as the pathologist will be busy "navigating" to the next plot and looking for diseases on roadside trees.

G. SAFETY

1. General

Safety shall be undertaken as a definite, aggressive, continuing part of disease survey work. Accident prevention and safety code compliance shall take precedence over immediate job production with SAFETY ALWAYS FIRST. Safe working methods should be learned in order to minimize hazards that cannot be removed. Proper clothing should be worn while taking plot data--boots with either composition or "nailed" soles and trousers without cuffs are a must.

A snake-bite kit should be carried by either one or both crew members at all times. A good first-aid kit should be available in the field car.

2. Car Travel

The motor vehicle is one of our greatest sources of injuries and deaths. Every driver should:

a. Drive in a way to avoid accident situations created by the mistakes of others or by weather and road conditions.

b. Yield the right-of-way even when, by all rules of the road, it is actually his.

c. Make an unbroken series of concessions to other drivers who are thoughtless, unskilled, or ignorant of the hazards they create.

d. Drive at a speed no faster than that which permits full control of the car at all times. This includes such factors as road, weather, and traffic conditions. He is the judge of these conditions and he had better be right.

e. Drive safely on curves and other places of poor or impaired visibility. The speed used under these conditions shall allow the vehicle to be completely stopped within less than half of the visible distance.

f. Know where he is going before he shifts into reverse. In dangerous areas use a signal man when backing a vehicle.

g. Put the vehicle in the lowest gear ratio, set the brake and block the wheels when parking where there is any possibility of the vehicle rolling.

h. Use common sense when behind the wheel.

i. Obey all State and local traffic regulations (thus know those regulations).

j. Remember that he is responsible--and not to take chances.

k. See that his vehicle is maintained and serviced to keep it in good repair and in safe running condition.

H. DEFINITIONS

1. Abnormal Growth

Growth resulting from a previous injury that altered the normal pattern of development is known as abnormal growth. The irregularity may take the form of a fork, burl, bayonet top, etc.

2. Basal Shoot

A small stem attached to a bole of a larger tree arising at or near ground level is known as a basal shoot. If dead it affords heart rots a point of entrance into the main tree bole.

3. Bayonet Top

This type of growth results from a broken or dead top being replaced by a turned-up limb or limbs. Usually the bayonet top starts from

the side of the bole and then turns upwards, thus forming an off-set in the tree's central axis at the point of the break.

4. Bole Wounds

a. General. Generally there is little doubt as to what caused a bole wound (fire scar, lightning scar, logging scar, etc.)--the difficulty is to determine the intensity. When intensity is being considered the size and age of tree, as well as the size and placement of the scar or wound, have to be considered. A logging scar extending up the bole of an 18-inch DBH white fir would be much more serious than one of the same height in a 40-inch DBH fir. Generally scars extending half way up the merchantable length of trees two logs or less in height are considered to be serious. Scars on taller trees must extend into the second log before they are classified as severe while those less than 6 feet in length are considered slight.

b. Redwood Bole Wound. In redwood cull indicators "bole wound" is used to describe any bole wound, scar, or catface extending into the heartwood but not to its center. It may be at any location on the bole and is most frequently caused by fire.

5. Broken Top

A broken top is rated the same as a dead top of equal size, age, etc.

6. Burl

Globose or subglobose swellings (hypertrophies) known as galls or burls are common on trees, although usually they occur on an occasional tree rather than on the majority in a stand. Galls or burls caused by rusts and dwarfmistletoes may affect many trees in a stand. A mistletoe burl is a definite swelling but one that hasn't reached the point of splitting the bark and exposing the wood. As soon as the wood is exposed the swelling is called a canker.

7. Canker

Swellings that have reached the point in their development where the bark has become split and the wood exposed are known as cankers. This term is particularly applicable to dwarfmistletoe.

8. Crook from Injury

This is a crook in the bole of a tree usually resulting from a dead or broken top, followed by a new leader arising from an upturned limb or a shoot from a proliferous or an adventitious bud. The crook usually is in proportion to the diameter of the tree at the time of the broken top--that is, the larger the diameter at the break, the greater the crook and the more chance of heart rot infection. Like other injuries a crook to be classified as old must be over 50 years of age.

9. Dead Top

A dead top is the top portion of the main stem of a tree that has died from any cause. Usually this leaves a dead spike or spike-topped tree. The severity depends upon the proportion of the bole that has died as well as the diameter of the junction of living and dead bole. When the dead top extends well into the merchantable portion of the bole it is severe. If the dead top only reaches or extends less than a log length into the merchantable bole it will be of moderate intensity (unless the tree has only one or two logs). A dead top that does not reach the merchantable portion of the bole will be classified as slight. See definition of "retained dead top."

10. Fork

Fork, as used here, refers to true or normal forks in which the main stem divides--and not to volunteer tops that have formed as a replacement for a dead or broken top. The stems of a true fork generally diverge from each other at a very acute angle and are joined at the base by a strong and tough crotch.

11. Frost Crack

This is a definite scar or opening through the bark and may extend well into the wood. It is an injury usually formed only during the dormant period when there is a sudden and pronounced drop in temperature (so that the inner wood remains comparatively warm, while the outer wood becomes cold and shrinks rapidly). Cracks usually originate in the base of the trunk, extend upward from a few to many feet, extend into the wood and split the bark. Healing of the wound produces considerable callous growth whereas repeated opening of the crack by cold or strains induced by wind will result in a very pronounced, protruding callous growth. The protruding callows, a visible deep crack and a long crack extending into the second log, generally means that the frost crack has been present for a long time and will be classified as old.

12. Goosepen

In redwood cull indicators this is a deep fire wound extending to or beyond the center of the heartwood and always at the base of the tree.

13. Initial Point

The initial point is the one located by drawing township, section and chainage within the section. The initial point on the map receives the plastic dot on which the draw number has been printed.

14. Leaning Tree

A lean--or deviation of the bole from the vertical position of 8 degrees or less--is classified as slight; over 8 degrees and up to

15 degrees is classified as moderate and over 15 degrees as severe. It must be remembered that trees with a lean of 20 degrees or more are given a high risk rating.

15. National Forests

When a plot is located within a National Forest the code for that forest is used. If the plot falls outside the National Forest boundary it should be coded as 00.

16. Old

This term, applied to intensity of wounds, injuries, etc., means that the wound is over 50 years old. A wound must be present long enough to allow heart rot to make its entry and to do considerable damage before cull factors apply. To call a wound old means the maximum cull will be deducted, hence 50 years was set as the dividing line between old and recent.

17. Orientation Point

This is a point--recognizable on both the ground and the map--along the route being traveled to a given plot. It should be the nearest recognizable point (such as a road junction, stream crossing, house, etc.) to the reference point. From the orientation point a definite distance is set (to the nearest one-tenth mile) that must be traveled to reach the reference point. This procedure eliminates personal judgment in selecting the reference point on the ground.

18. Ownership

There are many types of ownership involved, but the question may arise regarding "available" and "reserved." These terms refer to the timber and whether it is available for commercial use. For example, National Parks and Monuments, National Forest Wilderness Areas, State, County, and City Parks, certain watersheds, etc., are classified as reserved.

19. Plot Point

The plot point is the point from which plot data are started. It is located by using the "distance from the road and side of the road" draw and is situated 2 to 22 chains on either side of the road, but at a right angle to the road from the reference point.

20. Recent

An injury or bole wound that is less than 50 years old. See definition of "old."

21. Reference Point

The reference point is located by drawing a straight line from the initial point to the closest point on the nearest navigable road in the same subregion. The point of intersection of the line and road is the

reference point. It is from this point that actual measurements begin and from this point that the plot point is located.

22. Retained Dead Top

This term applies to a small dead top killed many years ago which has remained attached. In many cases a limb formed the new leader with little or no crook now remaining at the point of injury--and the dead top now protrudes from the bole of the tree. New growth has completely encircled it. This is common on trees girdled by porcupine many years ago.

23. Sapsucker Damage

Occasionally a sapsucker finds a tree to its liking and produces numerous perforated rings through the bark into the wood. Sometimes the bird or others of its species returns year after year and considerable damage is done to the tree. A swollen band 6-10 inches wide and up to 5-6 inches thick has been observed, and occasionally the bark on one side of the band is dead. Intensity rating is the same as in other injuries.

24. Snow Damage

Recognizable snow damage generally will be comparatively recent. It may be a snapped-off top, a bent bole, a leaning tree, or limbs broken off. Occasionally boles that were bent when young--and later either developed a new leader or partially recovered--can be recognized as old snow damage. The intensity rating is the same as that for other injuries.

25. Sucker Limb

A sucker limb is similar to a basal shoot but is attached higher on the bole. It is usually a small member of a true fork that has been excessively suppressed or died many years ago. Usually they are dead on larger trees.

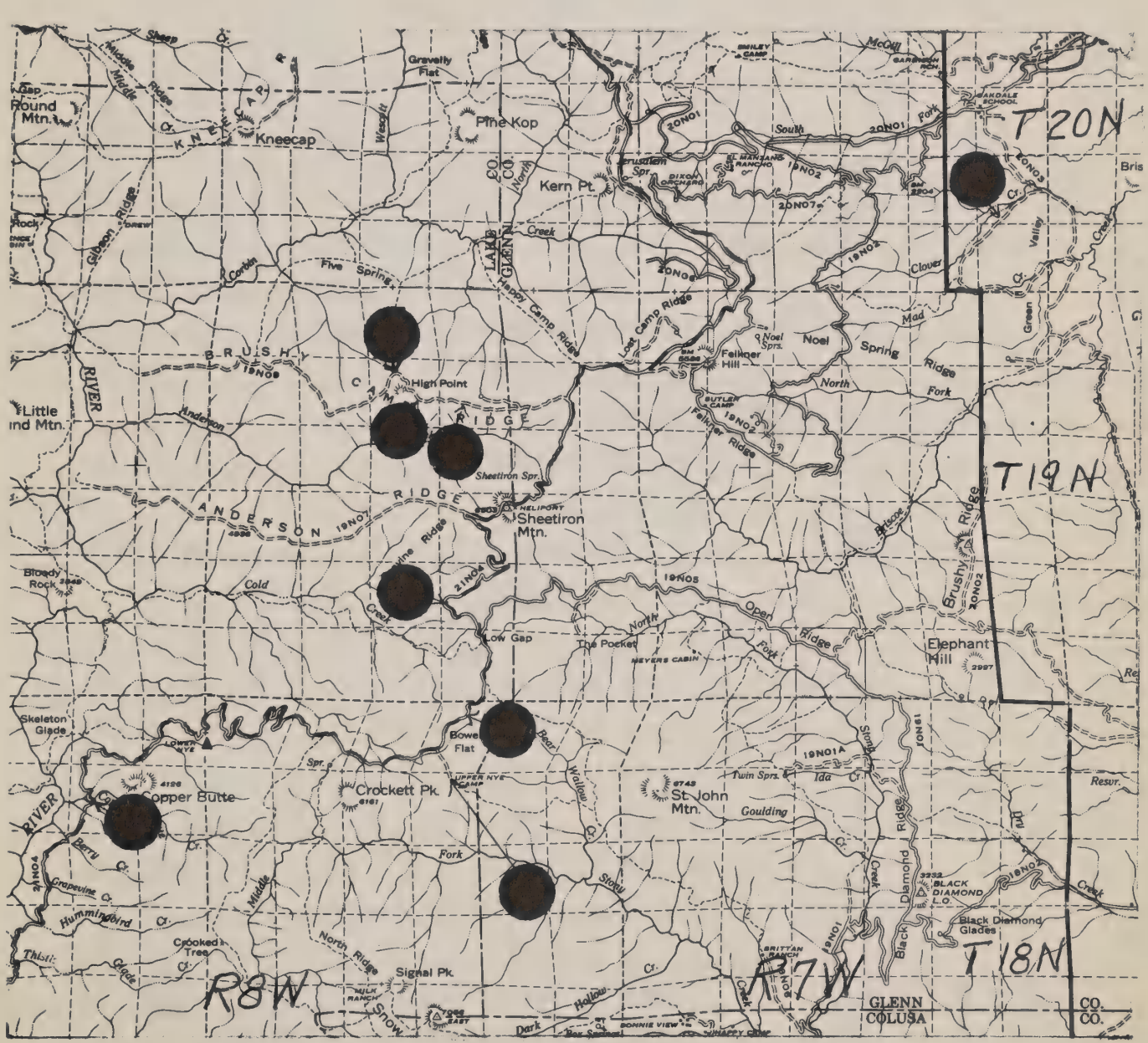
26. Sweep

A gradual bend or curve in the bole of the tree is known as a sweep. Frequently a tree has two sweeps, the second occurring as the trunk tends to straighten from the first, causing a curve in the bole in the opposite direction.

A P P E N D I X

SAMPLE MAP

A portion of the Mendocino National Forest showing some actual plot locations and how the plots are moved to the nearest road. Plots number 10 and 18 appear on the Draw Sheet.



DRAW SHEET

Subregion (4) CRP

244 TOWNSHIPS

Draw No.	Township No.	Section	No. chains Across	No. chains Down	TRP	ARP	Location Azimuth	Location Township	Location Range	Location Forest	Plot Name	Checked By	Checked Date	Reject--why?	Plot No.
1	73	9	15	50	-	12	65	38N	7W	Shasta	Eagle Cr.	HHB RSS	9/2/58	-	19
2	61	11	29	6	-	16	205	39N	7W	Shasta	Little Trinity R.	HHB RSS	9/2/58	-	18
3	240	16	74	50	-	15	257	12N	8W	Lake Co.					
4	136	27	49	52	7	-	150	2N	6E	Trinity	Eight Mile Ridge				
5	171	18	17	56	9	-	131	4S	6E	6-R's	Hammon Cr.	DRM HHB	8/2/61	Out of Type	-
6	144	5	46	67	-	5	22	31N	7W	Trinity	Shoemaker Bally	DRM HHB	6/16/60	-	23
7	82	34	67	51	-	11	253	37N	8W	Shasta	Eleanor Lake I	HHB RSS	8/29/58	-	12
8	168	21	51	4	-	13	230	27N	12W	6-R's	N.F. Mad River				
9	215	10	49	20	-	18	222	20N	9W	Mendo.	Bear Wallow	HHB RSS	7/6/58	-	2
10	217	25	8	56	-	19	185	20N	7W	Mendo.	Clover Cr.				
11	183	10	37	75	2	-	215	25N	10W	Mendo.	Pole Corral				
12	152	35	27	71	-	3	159	30N	9W	Trinity	Arbuckle Mt.				
13	77	13	32	11	-	7	55	8N	7E	6-R's	Grizzly Camp	DRM HRO HHB	6/7/61	-	27
14	22	3	28	62	-	3	50	44N	12W	Klam.	Scotts Bar. Mt.				
15	57	13	45	41	9	-	151	39N	11W	Klam.	Eddy Gulch	HHB RSS	8/30/58	Out of Type	-
16	216	6	27	56	-	18	78	20N	8W	Mendo.	Bear Wallow Ridge	HHB RSS	7/7/58	-	4
17	159	29	56	24	-	19	322	2S	6E	6-R's	Big Meadow	DRM RB	9/12/61	-	42
18	228	14	58	53	-	11	7	18N	8W	Mendo.	Nye Camp				
19	234	21	37	1	18	-	191	16N	8W	Mendo.	Jones	HHB RSS	7/2/58	No. Merch. Timber	-
20	112	24	14	59	-	19	41	34N	11W	Trinity	Ditch	HHB RSS	7/9/58	-	8
21	104	29	19	61	-	2	272	35N	8W	Trinity	Diener Mine #1	DRM HHB	6/6/61	-	26
22	164	18	25	67	-	14	99	28N	10W	Trinity	Round Mt. No. 2 #1				
23	164	19	68	1	-	22	147	28N	10W	Trinity	Round Mt. No. 2 #2				

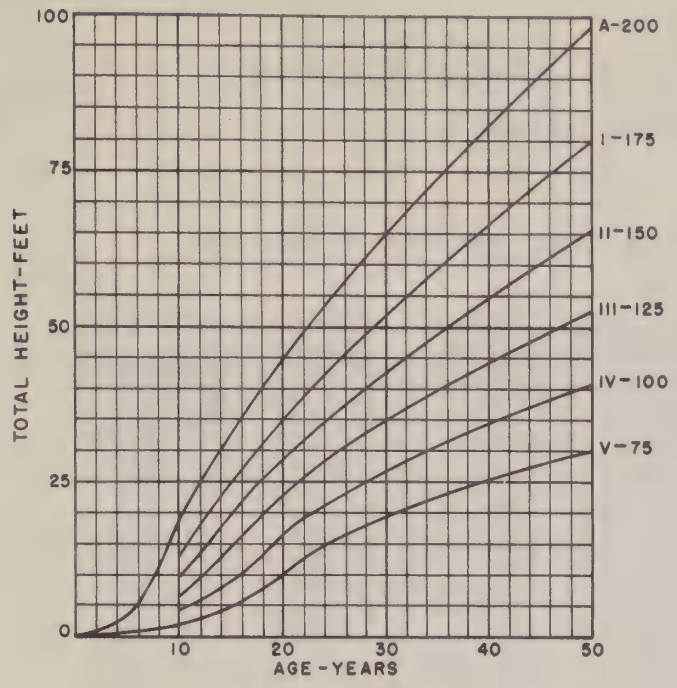


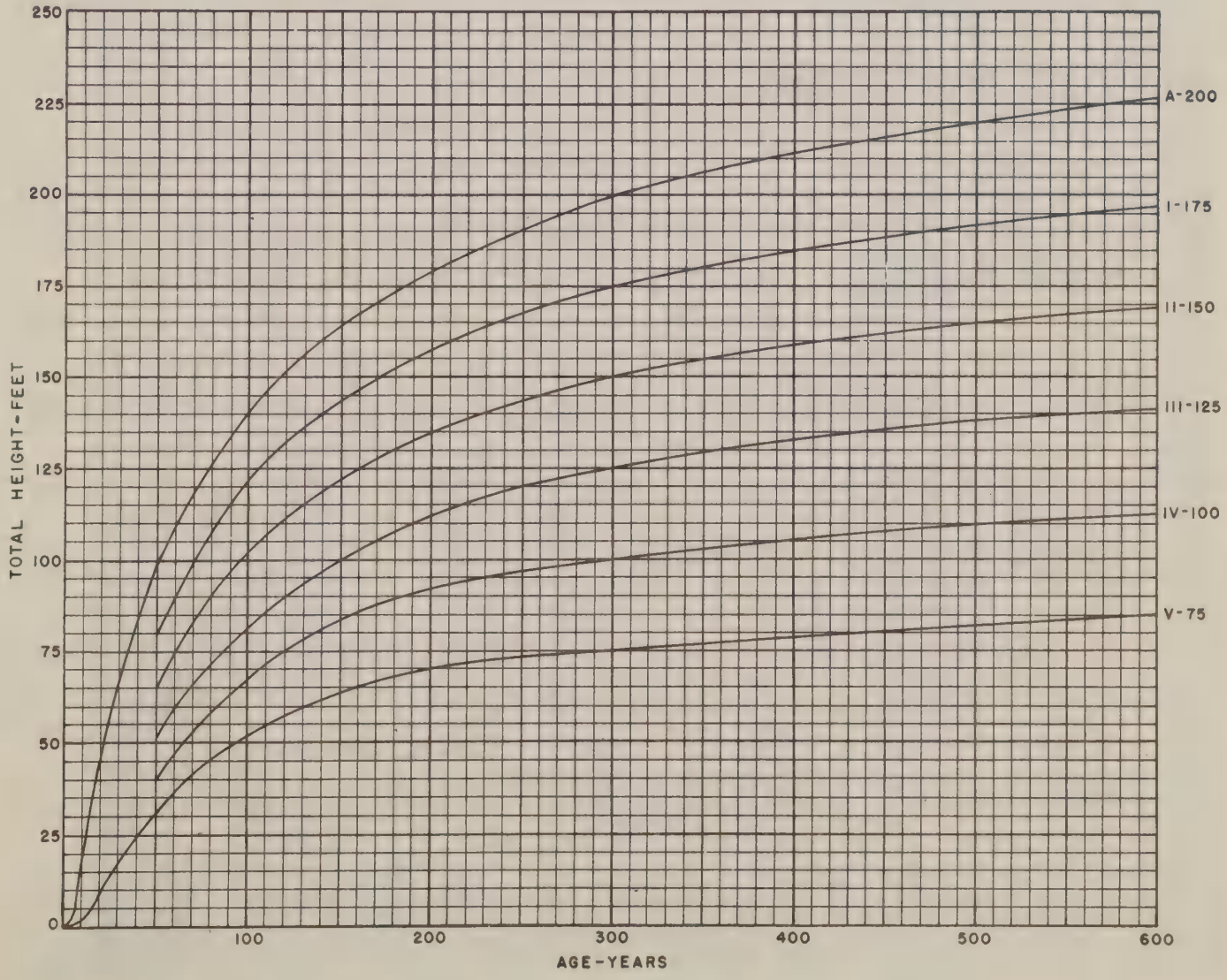
FIG. I
Res. Note No. 28

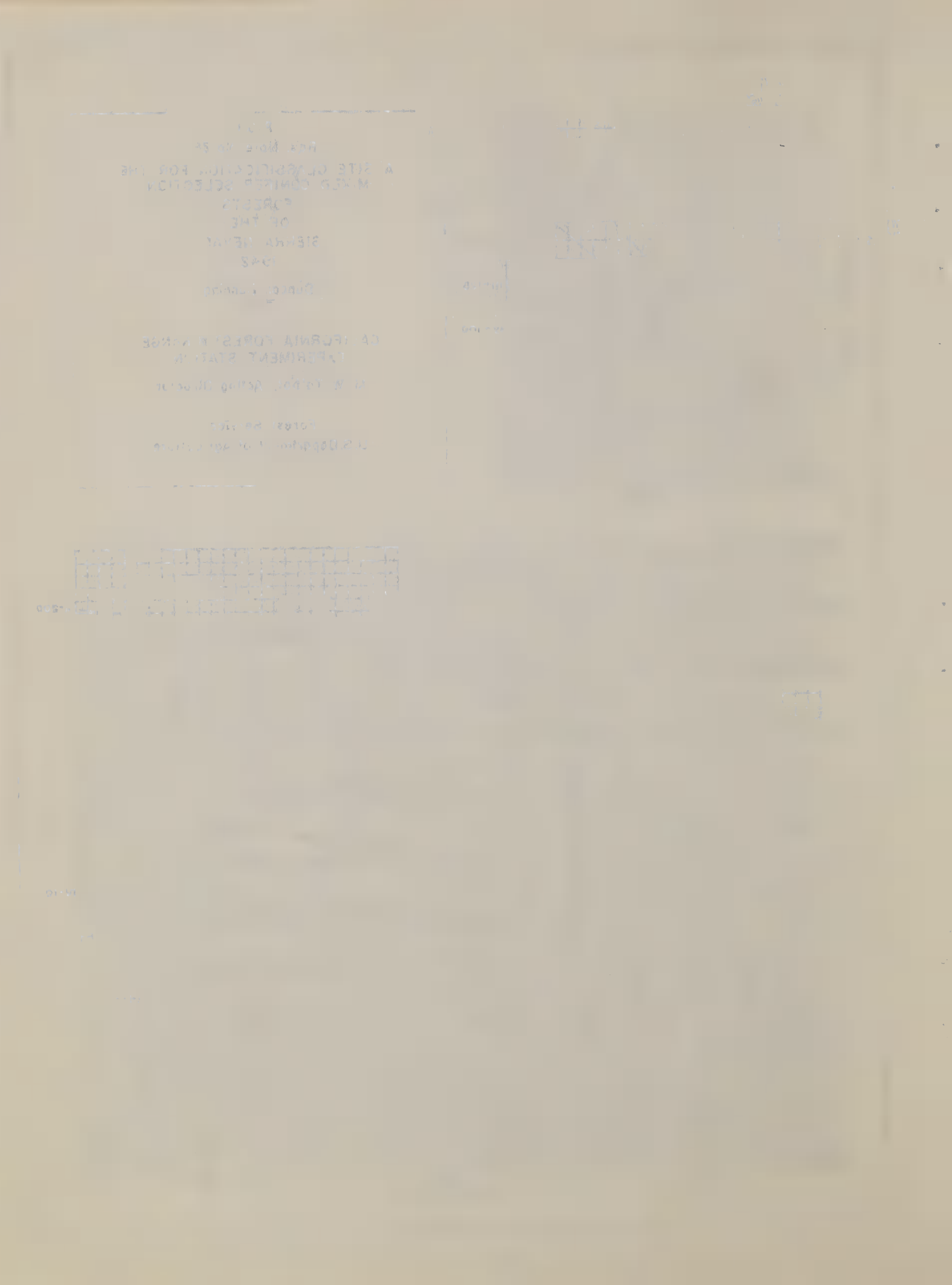
A SITE CLASSIFICATION FOR THE MIXED CONIFER SELECTION FORESTS OF THE SIERRA NEVADA
1942

Duncan Dunning

CALIFORNIA FOREST & RANGE EXPERIMENT STATION
M. W. Talbot, Acting Director

Forest Service
U. S. Department of Agriculture

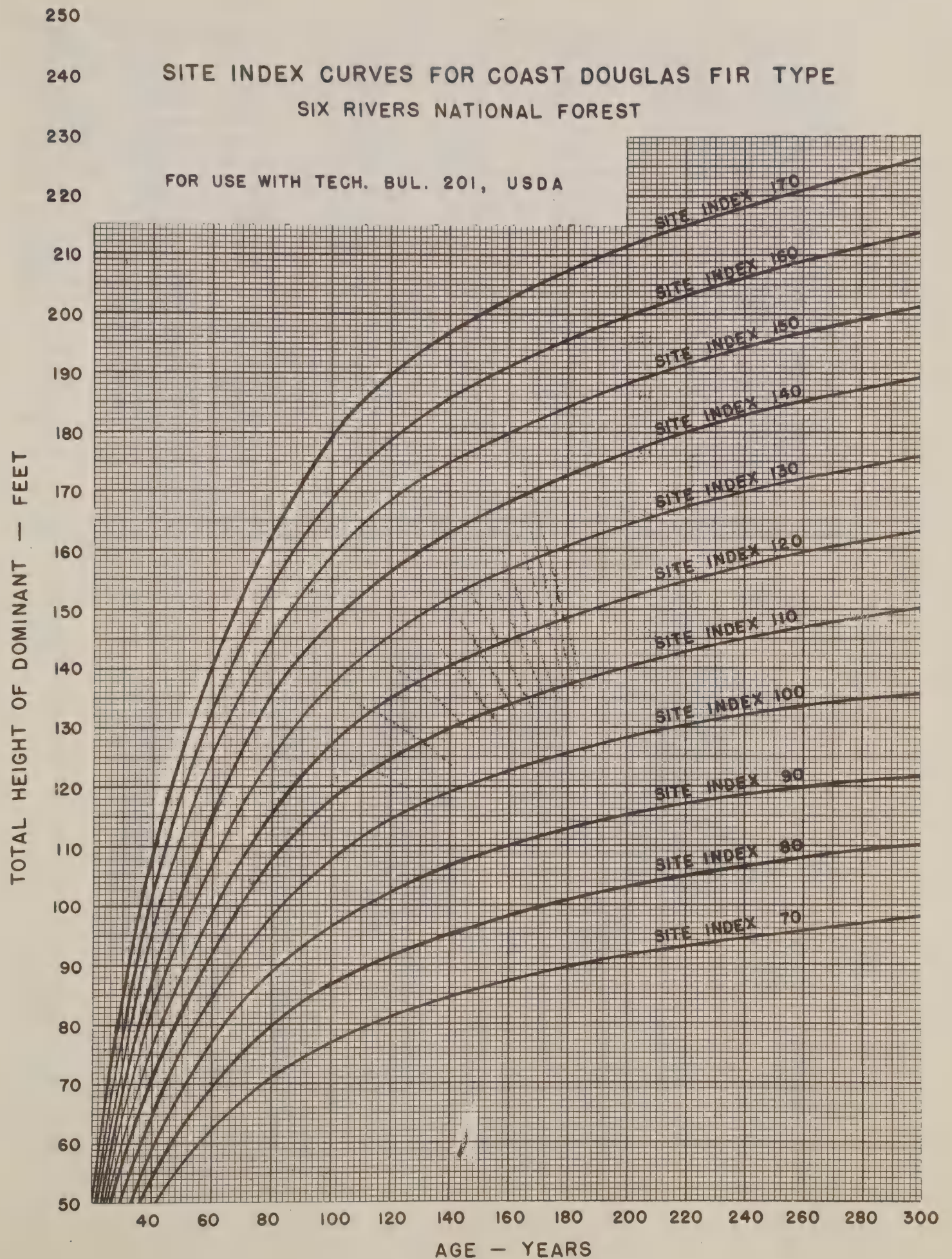




SITE INDEX CURVES FOR COAST DOUGLAS FIR TYPE

SIX RIVERS NATIONAL FOREST

FOR USE WITH TECH. BUL. 201, USDA



INDEX CURVES FOR COAST DOUGLAS FIR TYPE

TOTAL HEIGHT OF DOMINANT TREES - FEET

DESCRIPTION OF DUNNING'S TREE CLASSES

Item	1	2	3	4	5	6	7
Age Classes (Approximate)	Immature-Thrifty (60-150 Yrs)	Immature-Thrifty (60-150 Yrs)	Thrifty-mature or mature (150-300 Yrs)	Mature (150-300 Yrs)	Over-Mature (Over 300 Years)	Immature (60 - 150 Yrs)	Mature and Over-mature (Over 150 Yrs)
Position	Isolated or Dominant	Usually Co-dominant	Isolated or Dominant	Usually Co-dominant	Isolated or Dominant	Intermediate or Suppressed	Intermediate or Suppressed
Crown length: (Approximate)	65% or more	Up to 65%	65% or more	Up to 65%	Any length	Usually short	Usually short
Crown width	Average or wider	Less than Average	Average or wider	Less than Average	Any width	Any width	Any width
Seed bearing capacity	Fair	Poor	Very good	Greatest insect risk. Fair to Good.	Very good	Very poor	Poor
Form of top	Pointed 	Pointed	Rounded	Rounded	Flattened	Pointed Rounded	Flat
Vigor	Good	Good - Moderate	Moderate	Moderate - Poor	Poor	Moderate - Poor	Poor
Diameter (Approximate)	Rarely over 30 inches.	Up to 24"	18" to 40"	Except for the small, poorly developed crew, smaller size, and lower vigor, similar to Class No. 3.	Largest Trees	12" to 16"	Rarely over 18".
Bark	Dark, Ridges or small plates.	Dark; Ridges or small plates	Light brown or yellow; mod. large plates		Light yellow; wide, long smooth plates	Dark and rough ridged	Light yellow, thin and flat
Foliage	Rich green, dense, needles long and coarse	Rich green, mod. dense, needles long and coarse	Lighter green than #1, mod. dense; shorter than #1		Pale green, thin, tufty on ends of twigs.	Not so dense as #1 and #2	Very thin
Annual whorls	Distinct except on lower crown	Less distinct than #1	Nodes indistinct, branches horizontal or drooping		Branches drooping, gnarled and twisted, top flat	Internodes short	Indistinct. Branches few, and gnarled and drooping
Risk	Good	Good	Fair to good	Poor to fair	Poor	Fair to good	Poor

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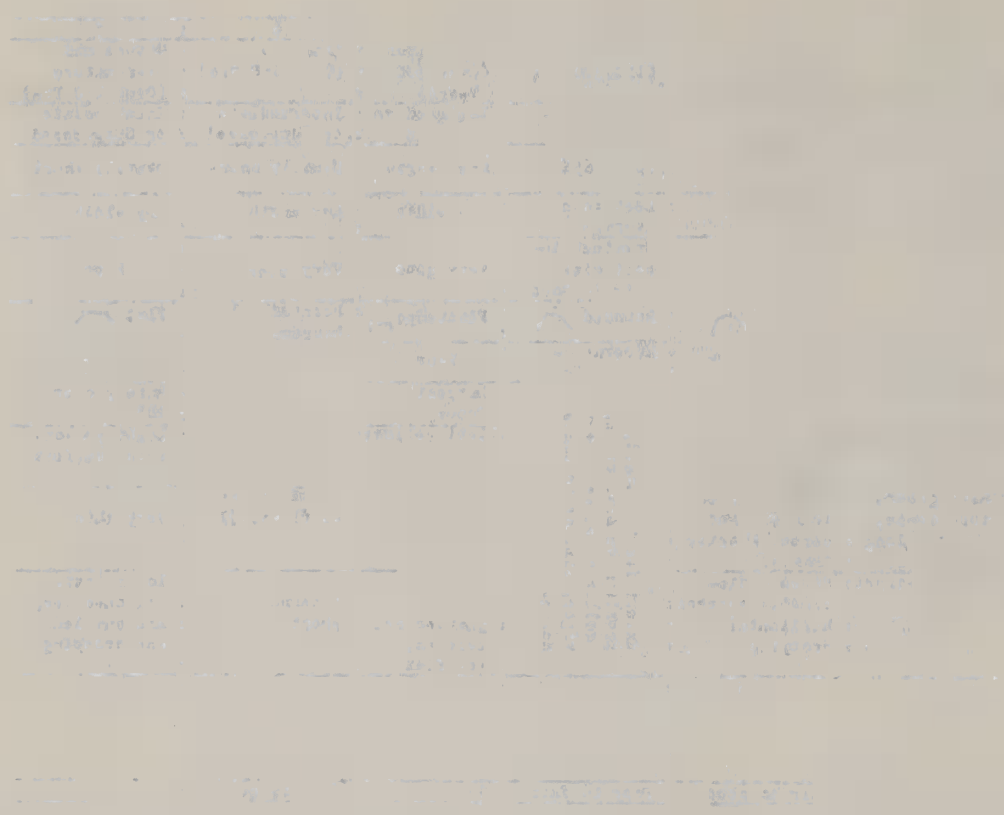

Table 1

Description of Keen's Tree Classes

Age Classes

Class 1

Young trees. Commonly referred to as "bull pines" or "black jacks"; thrifty trees making rapid height and diameter growth; age usually less than 80 years.

D.B.H.--Rarely over 20 inches.

Height.--In lower crown canopy; usually less than 60 per cent of total mature height.

Bark.--Dark, grayish brown to black; rough, and deeply furrowed without plates, but with narrow ridges between the fissures (sometimes coloring at extreme base).

Branches.--Upturned and in whorls for upper three-fourths of crown; small for diameter of bole.

Top.--Usually pointed, with distinct whorls.

Class 2

Immature trees. Still making rapid height and diameter growth in thrifty trees; age approximately 80 to 180 years.

D.B.H.--Rarely over 30 inches.

Height.--Usually less than 90 per cent of total height at maturity. Trees still under the general crown canopy.

Bark.--Dark reddish brown, with narrow, smooth plates between the fissures on lower half of bole; dark, rough bark on upper half.

Branches.--Mostly upturned and in whorls for upper half of crown; horizontal near middle, horizontal or drooping below; small to medium size for diameter of bole.

Top.--Usually pointed, sometimes rounded, but with whorls indistinct.

Class 3

Mature trees. Height growth practically complete; diameter growth slow; age approximately 180 to 300 years.

D.B.H.--Rarely over 40 inches.

Height.--Practically that of the general crown canopy, except intermediate, suppressed, or top-killed trees.

Bark.--Light reddish brown with moderately large plates between the fissures on lower three-fourths of bole; dark bark showing in upper quarter.

Branches.--Upturned near top, middle crown horizontal, lower ones drooping; moderately large for size of bole.

Top.--Usually pyramidal or rounded, occasionally pointed; whorls indistinct except at extreme top.

Class 4

Overmature trees. Making no further height growth; diameter growth very slow; age more than 300 years.

D.B.H.--Wide latitude in diameters, but usually large in dominant trees.

Height.--Full height of general crown canopy, except suppressed, spike-topped, or broken trees.

Bark.--Light yellow and uniform for entire bole, except in extreme top; plates usually very wide, long, and smooth; fissures often rather shallow.

Branches.--Large, heavy, and often gnarled or crooked; mostly drooping except in extreme top.

Top.--Usually flat; occasionally rounded or irregular.

Crown-Vigor Classes

Class A

Full Vigor

Crown.--Full vigorous crowns with a length of 55 per cent or more of the total height, and of average width or wider; with density average or better, for its age class.

Foliage.--Needles of average length or longer, usually dense and thrifty.

Position.--Usually isolated or dominant, rarely codominant.

D.B.H.--Large for age.

Class B

Good to Fair Vigor

Crown.--Good to moderately vigorous crowns, with length from 30 to 55 per cent of total height, if of average width and density; or a longer crown if narrow or somewhat thin; but neither sparse nor ragged.

Foliage.--Needles of average length, usually dense and thrifty.

Position.--Usually codominant, but sometimes isolated or dominant; rarely intermediate.

D.B.H.--Average or above for age.

Class C

Fair to Poor Vigor

Crown.--Fair to poor crowns, with length from 10 to 30 per cent of total height if of average width and density, or long, sparse, and narrow; often flat on one or more sides.

Foliage.--Needles often short and thinly distributed, but of normal length and density when confined to top one-third of crown.

Position.--Usually intermediate, sometimes codominant or suppressed, but rarely isolated.

D.B.H.--Usually below average for age; sometimes large in decadent trees.

Class D

Very Poor Vigor

Crown.--Very short, less than 10 per cent of the total height; sometimes merely a tuft at top of tree, or somewhat longer when sparse and ragged; usually very narrow or limbs all on one side.

Foliage.--Needles often short, and foliage sparse or scattered, or only tufts at end of twigs; but of normal length and density if reduced in quantity.

Position.--Usually suppressed or intermediate, but may occupy other positions if greatly reduced in vigor.

D.B.H.--Decidedly subnormal for age, but very old decadent trees may be of large diameter.

AGRICULTURE FOREST SERVICE SAN FRANCISCO

A PONDEROSA PINE TREE CLASSIFICATION

BASED ON AGE AND VIGOR

Descriptions of Insect-Risk Ratings - Ponderosa and Jeffrey Pine

The characters used in defining risk are concerned only with the apparent vigor of the crown as evidenced by the foliage, twigs and branches. Factors of age, crown form and crown position do not enter into the appraisal of risk from insect attack.

In the following descriptions, risk has been tentatively segregated into four groups. These four groups have been established primarily to provide sufficiently small gradations to allow for variation in application in selective logging practice. Where the prevention of insect loss in the near future is the primary objective, either the highest risk group alone (Risk 4) or the two highest risk groups (Risks 3 and 4) may be removed.

Risk 1. Low Risk: Full-foliaged, healthy appearing crowns. Foliage of healthy appearance, needles usually long and coarse, color good dark green. Practically all twigs with normal foliage complement. No weakened portions of crown. Code 1.

Risk 2. Moderate Risk: Fair to moderately healthy crowns, imperfect in spots. Foliage mostly healthy, needle length average or better, color fair to good. Some twigs or branches may lack foliage, but such injury should not be localized to form definite "weak" spots in crown. Code 1.

Risk 3. High Risk: Crowns of fair to poor health, somewhat ragged or thin in portions of crown. Foliage in parts of crown thin, bunchy, or unhealthy, needles average to shorter than average in length, color fair to poor. Some to many twigs or branches lacking foliage, some to many twigs or branches fading or dead. Small localized weakened portions of crown usually present. Code 3.

Risk 4. Very High Risk: Crowns in poor condition, ragged or thin, often showing evidence of active insect infestations in upper portions. Foliage thin or bunchy, needles short or sparse, color poor. Twigs and branches dead or dying, portions of crown definitely weakened. Active topkilling or partial infestations often present. Code 3.

Some types of tree injuries are not associated with a normal rating of risk. They may be the result of accident, such as lightning or mechanical injury, and when such injuries affect the immediate risk of infestation and early death they should be appraised independently of the characters given above for rating risk. In addition, the following tree characters are not considered to be primarily concerned with current risk.

An old bare spike, which is the result of an old topkilling injury from which the tree has recovered.

In some trees the foliage has a distinctly bunchy appearance although the needles are long. This condition apparently is a normal characteristic of a certain strain or type of pine tree.

In certain years and locations needles may be browned due to the effects of low temperatures.

Often, in seed years, needles behind the cones die and fade. Apparently, this fading has no relation to risk.

During the fall months of the year, the normal fading of old needle complements may create an appearance of high risk. This needle fall should not be counted as a factor in determining the risk of individual trees.

In addition to the insect-risk rating for ponderosa and Jeffrey pines, all tree species will be given a risk rating based on mechanical risk and disease risk. Trees with little or no risk characteristics present will be classified as good risk trees and code 1.

Mechanical: Under mechanical risk trees of any species which have been girdled to the extent of 50 percent or more by fire, logging or other causes; trees which have lost 50 percent or more of the sound wood in the basal area by fire, rot, or other causes; trees which lean more than 20 degrees from vertical; trees whose crown has been severely damaged by fallen trees, by wind or other causes; and trees which may become poor risks through removal of support (adjacent to road cuts) or disturbance of roots are considered as poor risks and code 4.

Disease: Trees of all species in which the decay offsets the growth so that there is no net increment; trees with large dwarfmistletoe cankers which cover half the circumference of the bole or which cover 1/3 the circumference and show signs of advanced heart rot in the canker surface; trees with a dwarfmistletoe trunk canker and a limb infection of 6; trees with 2 dwarfmistletoe burls and a limb rating of 6; trees having a limb or foliage infection rating of 7 or more; trees (five-needled pines) having a lethal trunk canker (blister rust) or a limb damage rating of 7; and trees definitely known to be infected with fomes root disease are considered as poor risks and code 5.

RISK CLASSES FOR PONDEROSA PINE

RISK 1
Low

RISK 2
Moderate

RISK 3
High

RISK 4
Very High

RISK CLASSES FOR PONDEROSA PINE

RISK 1
Low

RISK 2
Moderate

RISK 3
High

RISK 4
Very High

RISK CLASSES FOR PONDEROSA PINE

RISK 1
Low

RISK 2
Moderate

RISK 3
High

RISK 4
Very High

RISK CLASSES FOR PONDEROSA PINE

RISK 1
Low

RISK 2
Moderate

RISK 3
High

RISK 4
Very High

CODES FOR DISEASE AND INJURY

POLE & SAWTIMBER

	INJURY		INTENSITY
0	None	0	None
1	Frost crack	1	Slight - recent
2	Crook from injury	2	Moderate "
3	Dead top	3	Severe "
4	Broken top	4	Slight - old
5	Snow damage	5	Moderate "
6	Leaning tree	6	Severe "
7	Sapsucker	7	
8		8	
9	Unclassified	9	

	BOLE WOUNDS		INTENSITY
0	None	0	None
1	Fire scar	1	Slight - recent
2	Lightning	2	Moderate "
3	Falling tree	3	Severe "
4	Logging	4	Slight - old
5	Porcupine	5	Moderate "
6	Insects	6	Severe "
7		7	
8		8	
9	Unclassified	9	

	ABNORMAL GROWTH		SIZE
0	None	0	None
1	Fork	1	Small - live
2	Burl	2	Medium "
3	Basal shoot	3	Large "
4	Sucker limb	4	Small - dead
5	Bayonet top	5	Medium "
6	Retained dead top	6	Large "
7	Sweep	7	
8		8	
9		9	

SEEDLING & SAPLING

	INJURY
00	None
01	Fire
02	Snow
03	Frost
04	Logging
05	X-mas tree cut
06	Falling tree
07	Fork
08	Broken top
09	Browse
10	Rodent
11	Porcupine
12	
13	
14	
15	
16	
17	
18	
99	Unclassified

	DISEASES
00	None
	ROOT DISEASE (1 - 15)
01	P. schweinitzii
02	A. mellea
03	F. annosus
04	Verticicladiella
05	
06	
07	
08	
15	Unclassified
	RUST (16 - 30)
16	P. harknessii
17	C. stalactiforme
18	C. filamentosum
19	C. comandrae
20	C. ribicola
21	Gymnosporangium
22	M. caryophy
23	
30	Unclassified
	FOLIAGE DISEASES (31 - 45)
31	E. deformans
32	H. medusa
33	H. abietis-concolorus
34	H. montana
35	H. robustum
36	Snow mold
45	Unclassified
46	DWARFMISTLETOE
47	TRUE MISTLETOE
	PHYSIOLOGICAL (48 - 65)
48	Suppression
49	Drought
50	Cold injury
51	Heat injury
52	Flooding
53	Red belt
54	
55	
65	Unclassified
	HEART ROT (66 - 80)
66	F. pini
67	
68	
69	
80	Unclassified
98	INSECTS
99	UNCLASSIFIED DISEASES

INTENSITY for seedlings and saplings
(To be used for both injury and disease)

XX

1st Digit
% of size class affected

0	None
1	1-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-100

2nd Digit
Degree of damage to affected trees

0	None
1	Slight
2	Moderate
3	Severe
4	Slight to moderate
5	Slight to severe
6	Moderate to severe
7	Killing trees
8	
9	

CODES FOR PATHOLOGICAL DATA

HEART ROT

DISTURBANCE		INTENSITY	
0	None	0	None
1	F. pini	1	F. pini
2	E. tinct.	2	E. tinct.
3	F. offic.	3	F. offic.
4	P. adiposa	4	P. adiposa
5	P. amarus	5	P. amarus
6	A. mellea	6	A. mellea
7	Lentinus lepideus	7	L. lepideus
8	P. schweinitzii	8	P. schweinitzii
9	Unclassified	9	Unclassified

DWARFMISTLETOE

0	None	0	None
1	Branch inf. only	1	Light
2	Bole inf. only	2	Moderate
3	Branch & 1 burl	3	Severe
4	Branch & 1+ burls		
5	Branch & 1 canker		
6	Branch & 1+ cankers		
7	Branch, burl, & canker		
8	Branch & bole (but no burls or cankers)		

FOLIAGE DISEASES

0	None	0	None
1	E. deformans	1	Light
2	H. medusa	2	Moderate
3	Blue brooms	3	Severe
4	H. robustum		
5	H. abietis-concolorus		
6	Branch canker (unknown)		
7	Cytospora		
8			
9	Unclassified		

RUST

0	None	0	None
1	P. harknessii	1	Light
2	C. stalactiforme	2	Moderate
3	C. filamentosum	3	Severe
4	C. comandrae		
5	C. ribicola		
6	Gymnosporangium		
7	M. caryophy		
8			
9	Unclassified		

ROOT DISEASES

DISTURBANCE		INTENSITY	
0	None	0	None
1	P. schweinitzii	1	Tree weakened
2	A. mellea	2	Tree dying
3	F. annosus		
4	Verticicladiella		
5			
6			
7			
8			
9	Unclassified	9	

PHYSIOLOGICAL DISEASES

0	None	0	None
1	Suppression	1	Light
2	Drought	2	Medium
3	Cold injury	3	Heavy
4	Heat injury	4	Killing tree
5	Flooding		
6	Red belt		
7	Cork bark		
8	Sunscald		
9	Unclassified	9	

TRUE MISTLETOE

0	None	0	None
1	Branch inf. only	1	Light
2	Branch & bole inf.	2	Moderate
3		3	Severe
4			
5			
6			
7			
8			
9			

Rate top, middle, and lower 1/3 of crown from 0 to 3. Add these three ratings for overall tree rating of 0 to 9.

CODES FOR TREE DATA

	SOFTWOOD SPECIES
01	Douglas-fir
02	Bigcone Douglas-fir
05	Redwood
06	Giant sequoia
	Major Pines
11	Ponderosa
12	Jeffrey
13	Sugar
14	Western white
15	Lodgepole
	Minor Pines
21	Coulter
22	Monterey
23	Digger
24	Knobcone
25	Bishop
25	Torrey
25	Washoe
26	Apache
26	Bristlecone
26	Chihuahua
26	Foxtail
26	Limber
26	Whitebark
27	Pinyon
27	Mexican pinyon
27	Parry pinyon
27	Singleleaf pinyon
	True Firs
31	White
32	Calif. red
33	Grand
34	Pacific silver
35	Noble
36	Subalpine
36	Corkbark
37	Bristlecone
	Spruce
41	Englemann
42	Sitka
43	Black
44	White
44	Parsild
45	Blue
46	Brewer
	Hemlock
47	Mountain hemlock
48	Western hemlock
	Cedar
51	Incense
52	Alaska
53	Port Orford
54	Western redcedar
	Larch
55	Western larch
56	Subalpine
57	Tamarack

	OTHER SOFTWOODS
61	Calif. Torreya
62	Pacific yew
63	Alligator juniper
63	Calif. juniper
63	Common juniper
63	One-seed juniper
63	Pinchot juniper
63	Rocky Mt. juniper
63	Utah juniper
63	Western juniper
64	Arizona cypress
64	Gowan cypress
64	MacNab cypress
64	Modoc cypress
64	Monterey cypress
64	Tecate cypress
	HARDWOODS
71	Alder (all Alnus spp.)
72	Ash (all Fraxinus spp.)
73	Aspen (Quaking)
74	Birch (all Betula spp.)
75	Cottonwood (all Populus spp. except P. tremuloides)
76	Maple (all Acer spp.)
77	Willow (all Salix spp.)
	Oaks
81	Calif. black
82	Calif. live
83	Calif. white
84	Canyon live
85	Interior live
86	Oregon white
87	Tanoak
88	Other oaks
91	Calif. laurel
92	Cascara buckthorn
93	Golden chinquapin
94	Madrone
95	Dogwood
96	Sycamore (all Platinus spp.)
99	No live merchantable trees on subplot.

	Seedling and Sapling Size Classes
1	1 yr. to 0.5' high
2	0.6' to 4.5' high
3	4.6' to 0.9" Dbh.
4	1.0" to 1.9" Dbh.
5	2.0" to 2.9" Dbh.
6	3.0" to 3.9" Dbh.
7	4.0" to 4.9" Dbh.

	1/10-Inch Dbh. Classes
0087=	8.7
0440=	44.0
1032=	103.2
	etc.

	Dunning's Tree Classes
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	5A
9	Redwood and Hardwoods

	Keen's Tree Classes
11	1A
12	1B
13	1C
14	1D
21	2A
22	2B
23	2C
24	2D
31	3A
32	3B
33	3C
34	3D
41	4A
42	4B
43	4C
44	4D

Code	Risk Classes Description
1	Good risk trees (Salmon-Bongberg Classes 1 & 2)
2	Poor risk trees, no reason evident
3	Poor risk due to insects (S.-B. classes 3 & 4)
4	Poor risk-mechanical
5	Poor risk - disease
9	Hardwoods

	Merchantability Classes
0	Too small to be merch. (Short trees on poor sites)
1	Merch. tree
2	Sound cull tree
3	Rotten cull tree

CODES FOR PLOT DATA

SUBREGION

1	ES
2	WS, N½
3	WS, S½
4	CRP
5	RDF, N½
6	RDF, S½
7	So. Cal.

COUNTY

01	Alameda
02	Alpine
03	Amador
04	Butte
05	Calaveras
06	Colusa
07	Contra Costa
08	Del Norte
09	Eldorado
10	Fresno
11	Glenn
12	Humboldt
13	Imperial
14	Inyo
15	Kern
16	Kings
17	Lake
18	Lassen
19	Los Angeles
20	Madera
21	Marin
22	Mariposa
23	Mendocino
24	Merced
25	Modoc
26	Mono
27	Monterey
28	Napa
29	Nevada
30	Orange
31	Placer
32	Plumas
33	Riverside
34	Sacramento
35	San Benito
36	San Bernardino
37	San Diego
38	San Francisco
39	San Joaquin
40	San Luis Obispo
41	San Mateo
42	Santa Barbara
43	Santa Clara
44	Santa Cruz
45	Shasta
46	Sierra
47	Siskiyou
48	Solano
49	Sonoma
50	Stanislaus
51	Sutter
52	Tehama
53	Trinity
54	Tulare
55	Tuolumne
56	Ventura
57	Yolo
58	Yuba
99	No county name

PLOT SIZE

CODE	ACRES	STRIP LENGTH
0	.10	0-3.49
1	.25	3.5-7.49
2	.50	7.5-12.49
3	.75	12.5-17.49
4	1.00	17.5-22.49
5	1.25	22.5-27.49
6	1.50	27.5-32.49
7	1.75	32.5-37.49
8	2.00	37.5-44.99
9	2.50	45-50

ELEVATION

01	100 Feet
22	2200 "
	etc.

ASPECT

0	Level
1	North
2	NE
3	E
4	SE
5	S
6	SW
7	W
8	NW

SLOPE

1	Ridgetop
2	Sidehill
3	Canyon bottom & draw
4	Dry flat
5	Wet flat
6	Other

OWNERSHIP

Federal

01	Nat'l. Forest-available
02	" Parks & Monuments
03	Indian Lands-available
04	BLM Land outside of grazing district
05	BLM Land inside G.D.
06	Other Federal-available
07	Nat'l. Forest-reserved
08	Other Federal-reserved
11	State-available
17	State-reserved
21	County-available
22	County-reserved
23	Municipal-available
27	Municipal-reserved
30	All private (to be used when information for codes 31, 32, and 41 is not available)
31	Industrial
32	Other private
41	Farm
99	Any area for which ownership is not known or classified

NATIONAL FORESTS

01	Angeles
02	Cleveland
03	Eldorado
04	Inyo
05	Klamath
06	Lassen
07	Los Padres

NATIONAL FORESTS Con't.

08	Mendocino
09	Modoc
10	Plumas
11	San Bernardino
12	Sequoia
13	Shasta
14	Sierra
15	Six Rivers
17	Tahoe
18	Trinity
00	Outside N. F.

SITE - MIXED PINE

0	200 Super site
1	175 High site
2	150 Medium high
3	125 Medium low
4	100 Low site
5	75 Very low
9	Noncommercial, nonforest, or unknown

SITE - DOUGLAS-FIR & REDWOOD

0	200 Very high site
1	170 High site
2	140 Medium site
3	110 Low site
4	80 Very low
5	
9	Noncommercial, nonforest, or unknown

TYPE

01	Pine
02	Redwood
03	Douglas-fir
04	Fir
05	Mixed conifer (Pine - Douglas-fir - fir)
06	Lodgepole pine - Mt. Hemlock
07	Juniper - pinyon.

STAND SIZE CLASS

0	Old-growth sawtimber - uncut
1	" " " - cut
2	Young-growth sawtimber - uncut
3	" " " - cut

DENSITY

1st digit = sawtimber
2nd digit = all timber

11	Well stocked (70 - 100%)
22	Medium (40 - 69%)
33	Poor (10 - 39%)
66	Nonstocked (0 - 9%)

STAND TREATMENT

1	Virgin
2	Recent partial cut (less than 50%)
3	Old " " " " "
4	Recent " " (more than 50%)
5	Old " " " " "
6	Recent clearcut
7	Old clearcut

CULL INDICATORS

Cull in white fir, California red fir, and Douglas-fir is comparatively greater than in most of the other commercial conifers. Also, there is considerable variability in amount of cull in these species within a subregion. For these reasons, flat factors applicable to an entire subregion were considered inadequate to provide the desired accuracy of net volumes for these three important species. Fortunately, external indicators are associated with the principal kinds of defect in trees of these species. The following indicators of cull were found to be the most useful:

Conks of Indian paint fungus, Echinodontium tinctorium;
Conks and swollen knots of ring scale fungus, Fomes (Trametes) pini;
Conks of quinine fungus, Fomes officinalis (F. laricis);
Fire scars and other butt scars;
Conks of velvet top fungus, Polyporus schweinitzii;
Dead or broken tops.

Descriptions

Conks of the Indian paint fungus are probably recognized by all cruisers who work in white and red fir stands, as they are the most common conks on these firs. They are hard, woody, hoof-shaped and perennial, ranging from a few inches to over a foot in width. The upper surface is black, dull, rough, and cracked, and the under-surface is grayish, level, and thickly set with hard, coarse spines. The interior, or context, is rusty-red or brick-red in color. The conks usually occur on the underside of dead branch stubs. When they occur high in a tree among the live branches they are often difficult to see, especially if the light is poor. A single conk usually indicates limited decay, and several conks some distance apart often indicate a multiple infection and usually a cull tree. If limited cull is indicated by a single conk or a compact group of conks, the extent of cull is related to the location of the infection in the bole. Cruisers should note the location by lower 1/3, middle 1/3, or upper 1/3 of the "merchantable bole", or sawlog portion of the bole. If any 2 conks are separated more than 5 feet vertically, the cull should be considered as extensive. Indian paint fungus conks are rarely found on Douglas-fir.

Conks of the ring scale fungus, rarely found on the true firs, are the most common conks found on Douglas-fir and are readily recognized by all experienced cruisers. These variable perennial conks may be thin shell-shaped to bracket-like or irregularly hoof-shaped. They range from 1 or 2 inches to more than a foot in width, with an average width of 4 to 8 inches. The upper surface is rough, dull grayish or brownish black, with approximately concentric furrows parallel to the lighter brown margin. The under surface is a grayish to rich brown in color, and the mouths of the small tubes of which it is composed vary from small and almost circular to large and irregular. On living trees the conks usually issue from knots or branch stubs along the bole. When they occur high in the crown of a large tree they are difficult to spot from the ground, and considerable experience is necessary for a cruiser to develop an ability to locate them readily. As with the Indian paint fungus conks, the ring scale conks indicating limited cull (non separated by more than 10 feet vertically) should be recorded as occurring on lower, middle or upper 1/3 of the

merchantable bole. Cull is considered as extensive when any 2 conks are separated by more than 10 feet vertical distance.

Swollen knots or punk knots are also excellent indications of ring scale fungus decay, although in the California forests these indicators are usually accompanied by conks. The swelling results from an attempt to heal over a punk knot and may indicate the beginning of a new conk, but usually indicates an abortive conk or the point from which an old conk has dropped. Cruisers may easily recognize swollen knots on living trees and should consider them as analogous to conks.

Burl-like growth should not be confused with swollen knots, as they are not ordinarily indicators of cull.

Conks of the quinine fungus are not as commonly known to woodsmen as those of the Indian paint fungus and ring scale fungus because they are not prevalent. But they are distinctive in appearance and are easily recognized once they have been identified. They are long, cylindrical, pendulous or roughly hoof-shaped. They attain considerable age, and when they develop in the cylindrical shape they may be 10 to 18 inches or more long. The upper surface is chalky white or brownish, rough and zoned, whereas the under surface is white, when fresh, with small, round pores. When dried, the pore surface darkens, becoming light brown in color. The substance of a conk is white, soft and cheesy when young, and rather crumbly and chalky when old and dry, with an intensely bitter taste. The conks issue from knots or old wounds, and often are found in association with broken tops in Douglas-fir. They may be found on either of the true firs or on Douglas-fir, and a single conk usually indicates a cull tree.

Old fire scars or catfaces on the butts of trees are abundant in the California forests. They provide points of entrance for various fungi, as do dwarf-mistletoe cankers and other serious basal trunk wounds that expose the heartwood. Decay fungi entering such wounds often cause a large part of the cull.

The common butt rot caused by the velvet top fungus is often found associated with fire scars in Douglas-fir, and frequently this fungus produces conks on the scar or on the ground at the base of a tree that does not have a visible scar, in which case they indicate butt rot comparable to that associated with fire scars. The cruiser should record conks of velvet top fungus as old fire scars. On the ground, when viewed from above, the conk is more or less circular in shape and sunken in the center, tapering to a short thick stalk. The upper surface of fresh conks is velvety, concentrically zoned, and reddish brown in color with a tan margin; the under surface is greenish in color and turns red-brown when bruised. The mouths of the tubes are large and irregular in shape. The substance of the conk is moist and cheesy. The conks turn a deep red-brown or blackish brown when old and they become corky and easily broken. On the tree the conk is a thin bracket, and frequently one or more brackets grow one above the other. The conks are annual and develop most abundantly during moist weather in the late summer and fall, but their dried remains may be evident for a year or more following their development. Often the broken remains of old conks on the ground are the only indication a cruiser has of extensive decay in the tree butt.

Old broken or dead tops afford excellent points of entrance for decay fungi and, when low enough to involve the sawlog portion of the bole, they usually indicate extensive cull in Douglas-fir and some cull in white and red firs. All such broken or dead tops should be recorded by the cruiser. Recently killed or broken tops, or dead or broken tops so high that they do not involve the sawlog portion of the bole, may not indicate a cull loss if the trees are harvested soon.

There are other cull indicators that are of minor importance and usually more difficult to recognize, and some cull may exist that is not associated with a recognizable indicator. Likewise, some of the cull indicators may be missed by the most experienced cruisers, so that a portion of existing cull is not associated with recorded indicators. To compensate for this "hidden" cull and overlooked indicators, the cull factors given in column number one of tables 1 and 2 for quinine fungus conks, or for scattered Indian paint fungus or ring scale fungus conks, have been increased somewhat over actual cull averages for these indicators.

Cull Factors

The cull factors that apply to the board-foot volume of the sawlog portion of the bole are given first, for Douglas-fir in table 1 and for white and red firs in table 2. The cull factors for Douglas-fir are given for three different site index groups, and those for white and red firs, for four site index groups.

CULL FACTOR TABLE FOR DOUGLAS-FIR

TABLE 1

DOUGLAS-FIR						Single or compact group of F. pini conks - none separated by more than 10 feet vertical distance on											
						Lower 1/3 of Merchantable bole				Middle 1/3 of Merchantable bole				Upper 1/3 of Merchantable bole			
Dbh. Class	Site	F. pini conk or F. pini conks more than 10' apart vertically	Old fire scar	Dead or broken top extending into merchantable bole	Fire scar plus dead or broken top	Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top	Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top	Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top
12		100	69	2	71	69	69	71	71	49	83	63	100	43	100	43	100
14		100	62	8	70	62	62	70	70	43	81	61	100	38	100	38	100
16		100	56	13	69	56	56	69	69	38	78	59	100	33	95	33	89
18		100	48	17	63	48	48	65	65	35	75	57	98	28	76	28	76
20	A	100	40	21	61	43	43	64	64	32	71	55	96	25	65	25	65
24		100	32	27	59	38	38	65	65	28	60	51	85	19	51	27	59
30		100	26	34	60	35	38	69	73	24	50	48	69	14	40	34	60
36	I	100	23	40	63	32	41	72	80	21	44	46	64	12	35	40	63
42		100	22	46	68	29	40	75	85	19	41	46	65	10	32	46	68
48		100	23	50	73	26	39	76	88	18	41	50	66	9	32	50	73
54		100	25	52	77	24	38	76	90	17	42	52	67	8	33	52	77
62		100	26	54	80	22	37	76	91	16	42	54	68	7	33	54	80
72		100	27	55	82	21	36	76	92	15	42	55	68	6	33	55	82
12	II	100	61	3	64	61	61	64	64	79	87	82	100	36	97	36	97
14		100	52	9	61	52	52	61	61	49	85	65	100	30	82	30	82
16		100	47	16	63	47	47	63	63	40	83	58	100	26	73	26	73
18		100	43	22	65	43	43	65	65	35	79	54	97	24	67	24	67
20		100	40	28	68	41	41	69	69	32	72	51	91	21	61	26	68
24		100	35	36	71	40	40	76	76	27	62	48	83	18	53	36	71
30	II	100	30	44	74	39	40	83	84	25	55	46	76	15	45	44	74
36		100	27	49	76	38	43	87	90	24	51	49	76	13	40	49	76
42		100	27	52	79	37	44	89	97	23	50	52	79	12	39	53	79
48		100	27	56	83	35	44	91	100	22	49	56	83	11	38	56	83
54		100	28	59	88	32	43	90	100	21	49	59	87	10	38	58	88
62		100	30	62	95	29	41	88	100	20	50	62	92	9	38	61	95
72	II	100	31	63	100	26	40	86	100	19	50	63	94	7	38	63	100
12		100	79	3	82	79	79	82	82	100	100	100	100	43	100	43	100
14		100	70	10	80	70	70	80	80	77	95	79	100	39	100	39	100
16		100	63	17	80	63	63	80	80	48	91	66	100	35	98	35	98
18		100	56	23	79	56	56	79	79	43	87	62	100	31	87	33	89
20	III	100	50	28	78	50	50	79	79	40	83	58	100	28	78	32	82
24	IV	100	41	36	77	43	43	79	79	35	76	52	93	22	63	36	77
30		100	33	44	77	39	39	83	83	31	64	48	81	17	50	44	77
36	V	100	29	47	76	38	38	86	86	29	58	47	76	14	43	47	76
42		100	28	51	79	41	41	92	92	29	57	51	79	12	40	51	79
48		100	31	61	92	45	45	97	97	28	59	61	92	10	41	61	92
54		100	35	75	100	47	47	100	100	27	62	75	100	8	43	75	100

TABLE 3

INCENSE-CEDAR

Dunning Class	Percent of gross board-foot (Scribner Decimal C) Merch. Vol. Cull	Breakage
1	6.2	2.2
6	6.3	2.2
2	8.3	2.2
3	20.9	2.2
7	28.1	2.2
4	30.3	2.2
5	67.7	2.2

In open stands on dry east slopes in the typical Eastside Sierra Subregion, cull factors equll to one-half the values given should be used.

CULL FACTOR TABLE FOR WHITE AND RED FIR

TABLE 2

WHITE AND RED FIR Dbh. Class	Site	F. offic. conk or E. tinct. conks more than 5' apart vertically	Old fire scar	Dead or broken top extending into merchantable bole	Fire scar plus dead or broken top	Single or compact group of E. tinct. conks - none separated by more than 5' on											
						Lower 1/3 of merch. bole				Middle 1/3 of merch. bole				Upper 1/3 of merch. bole			
						Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top	Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top	Alone	With fire scar	With dead or broken top	With fire scar & dead or broken top
12	A	80	79	32	80	80	80	80	80	80	80	80	80	80	80	80	80
14		85	58	20	73	72	72	85	85	77	81	77	85	55	78	55	78
16		89	46	15	61	66	66	81	81	70	82	70	89	46	76	46	76
18		92	41	11	52	63	63	74	74	60	83	65	92	41	74	41	74
20		94	38	9	47	60	60	69	69	52	83	63	94	37	72	37	72
24		97	36	7	43	57	57	64	64	47	84	61	97	32	68	32	68
30	A	99	35	8	42	55	55	63	63	45	85	60	99	28	63	28	63
36		100	35	10	45	54	54	64	64	44	83	58	100	24	58	24	58
42		100	35	13	51	53	53	66	66	42	79	56	98	20	55	20	55
48		100	34	16	52	52	52	68	68	40	76	54	94	18	52	18	54
54		100	34	19	53	51	51	70	70	38	72	53	89	16	50	19	53
62		100	33	21	54	50	50	71	71	35	69	50	82	15	48	21	54
72	A	100	32	23	55	49	49	72	72	33	65	47	78	13	45	23	55
12	I	85	81	23	85	85	85	85	85	85	85	85	85	85	85	85	85
14		87	69	16	82	79	79	82	82	82	87	82	87	55	84	55	84
16		89	59	13	72	74	74	80	80	78	88	78	89	46	82	46	82
18		91	52	11	63	71	71	78	78	74	89	75	91	41	81	41	81
20		93	46	10	56	67	67	77	77	71	90	73	93	38	79	38	79
24		96	41	9	50	64	64	73	73	65	91	68	96	34	75	34	75
30	I	99	39	8	47	62	62	70	70	57	92	63	98	29	68	29	68
36		100	39	8	47	60	60	68	68	52	91	58	99	25	64	25	64
42		100	39	8	47	59	59	67	67	48	88	56	99	22	61	22	61
48		100	39	10	49	57	57	67	67	45	84	54	98	20	59	20	59
54		100	38	13	51	55	55	68	68	42	80	52	96	18	56	18	56
62		100	37	16	52	53	53	69	69	39	76	51	91	16	52	16	52
72	I	100	35	18	53	52	52	70	70	37	72	50	84	15	50	18	53
12	II	90	89	19	90	90	90	90	90	90	90	90	90	90	90	90	90
14	&	90	76	17	85	85	85	90	90	89	90	90	90	83	90	83	90
16	III	91	65	15	79	81	81	90	90	88	91	91	91	68	89	68	89
18		92	55	14	69	78	78	90	90	86	92	92	92	58	88	58	88
20		93	50	13	63	76	76	89	89	84	93	93	93	51	86	51	86
24	II	95	47	10	57	72	72	82	82	80	94	90	95	40	82	40	82
30	&	98	47	8	55	68	68	76	76	71	94	79	98	31	75	31	75
36	III	100	46	7	53	66	66	73	73	62	94	69	100	26	71	26	71
42		100	46	6	52	65	65	71	71	53	94	59	100	23	68	23	68
48		100	46	6	52	64	64	70	70	48	94	54	100	20	66	20	66
54	II	100	45	5	50	63	63	68	68	47	94	53	99	18	64	18	64
62	&	100	45	6	51	62	62	68	68	47	94	52	99	17	62	17	62
72	III	100	44	7	52	61	61	68	68	46	94	52	98	16	60	16	60
12	IV	100	100	23	100	100	100	100	100	100	100	100	100	100	100	100	100
14		97	84	22	95	97	97	97	97	97	97	97	97	97	97	97	97
16		96	73	21	91	95	95	96	96	96	96	96	96	92	96	92	96
18		95	65	20	85	93	93	95	95	95	95	95	95	84	95	84	95
20		96	59	19	78	90	90	95	95	95	96	95	96	71	95	71	95
24		99	55	17	72	84	84	94	94	94	98	94	99	55	95	55	95
30	IV	100	54	15	69	76	76	88	88	93	100	93	100	44	95	44	95
36		100	56	12	68	71	71	82	82	81	98	84	100	38	94	38	94
42		100	58	10	68	70	70	79	79	70	96	74	100	34	92	34	92
48		100	60	8	68	70	70	78	78	66	95	72	100	30	90	30	90
54		100	62	6	68	69	69	76	76	64	95	70	100	27	88	27	88
62T	IV	100	61	8	68	68	68	76	76	63	94	68	100	22	83	22	83

FACTORS FOR INCENSE-CEDAR

Cull factors for incense-cedar are given in table 3. The great bulk of incense-cedar occurs in the westside type, but a considerable amount also occurs in an intermediate type where cull is similar to that on the westside. The cull factors presented here are for these two types. Only a relatively small amount of cedar occurs in the typical eastside forest. A cull study conducted in this type near Eagle Lake, Lassen National Forest, on an open, dry, east slope showed cull in incense-cedar to be approximately one-half that on the westside. It is therefore, suggested that cruisers who encounter this species on extra-dry sites in the eastside subregion, apply cull factors equal to one-half those given in table 3. On other eastside sites, the entire factors are applicable.

Table 3.--Percent cull and percent breakage in incense-cedar in the Sierra Nevada 1/ -- by Dunning's tree classes

Tree Class	Percent of gross board-foot (Scribner Decimal C) merchantable volume	
	Cull	Breakage
1	6.2	2.2
6	6.3	2.2
2	8.3	2.2
3	20.9	2.2
7	28.1	2.2
4	30.3	2.2
5	67.7	2.2

1/ In open stands on dry east slopes in the typical Eastside Sierra Subregion, cull factors equal to one-half the values given should be used.

The basis for these cull factors was provided by studies made at 5 locations. Two were cull studies and 3 dissection studies involving 1,536 trees of all tree classes. The supplemental study made near Eagle Lake consisted of 100 incense-cedar trees.

Breakage in incense-cedar is inconsiderable in comparison to the large amount of cull and generally differs little by tree classes. Hence it was desirable to use but one average breakage factor for all tree classes. In timber sales and cull studies at 19 different localities distributed throughout the Sierra Nevada, the average breakage factor for this species was 2.2 percent (table 3).

CULL INDICATORS FOR REDWOOD

The amount of cull may vary considerably in redwood trees within a given diameter class at different latitudes, or on different sites at any given latitude. In general, the cull factors were found to be progressively larger from the southern to the northern parts of the redwood range, and at a given latitude they became larger with increase in elevation. Accompanying these increases in cull are general increases in the frequency of cull indicators.

The following were found to be reliable indicators of significant amounts of cull:

1. Bole wound. Any bole wound, scar, or catface extending into the heartwood but not to its center. It may be at any location on the bole. It is frequently caused by fire.

2. Goosepen. A deep fire wound extending to or beyond the center of the heartwood and always at the base of the tree.

3. Broken top. Any broken-out top regardless of location, or any large sucker-type branch regardless of location on the bole. This does not include spike, or dead tops that are not broken out, or adventitious or epicormic branching caused by a recent source of additional side light to the trunk. The large sucker-type branches seem to be stimulated by extensive cull in the upper bole, which usually starts in a broken-out top. Often, other indications of the old broken top are not discernible from the ground.

Use of Cull Indicators

Trees having none of these three indicators should be classed as having no indicators. Spike or dead tops alone are not associated with appreciable percentages of cull; therefore, such trees should be considered as trees with no indicators. All cull that is not associated with recognized indicators is taken care of by the smallcull factors for trees with no indicators. These factors become smaller as the trees become older, because cull indicators develop as the trees grow older. About 50 percent of the study trees below 71 inches d.b.h. had no recognized cull indicators; 12 percent over 100 inches d.b.h. had none. Only one study tree over 110 inches d.b.h., and none over 120 inches had no recognized cull indicators. Breakage factors for trees with no cull indicators are somewhat larger than for trees with indicators.

A single tree may have more than one cull indicator. However, except for bole wounds, the number of like indicators has no significance in applying cull factors. For example, five sucker branches would require the same cull factor as one sucker branch. The cull indicators may be considered of two general classes as to location: lower bole and upper bole.

Broken top or sucker shoots are always in the upper bole, and goosepen is always in the lower bole, while bole wound may be in either the upper or lower bole. When two indicators occur on a tree, their cull factors are additive only if one is in the upper bole and the other in the lower bole. A bole wound is disregarded when it occurs in the lower bole with a goosepen or in the upper bole with a broken top.

Thus, only four combinations of factors are possible in a tree:

1. Goosepen + broken top.

2. Broken top + bole wound in lower bole.

3. Goosepen + bole wound in upper bole.

4. Bole wound in lower bole + bole wound in upper bole.

Since there is often an overlapping of defect from broken top with that from lower indicators, cull factors have been worked out for combinations 1 and 2 and are included in the tables. In combination 3, the two cull factors are directly additive. In combination 4, the cull factor for bole wound is simply doubled.

Wide-crotched forks in the bole usually indicate an old broken top and should be so considered, while acutely angled forks usually do not indicate appreciable cull. Flat or dubbed-off tops in trees are not always caused by old broken-out tops. Such trees should not be regarded as having a broken top unless there is some other evidence, such as sucker-type branches, indicative of a broken top.

Table 4. - Indicator factors 1/ for gross board-foot volume to a 12-inch top

Cull and breakage in trees without, and in trees with, cull indicators in old-growth redwood--by 10-inch d.b.h. classes

D.b.h. class, inches	Trees with no indicators		Trees with indicators					
			Cull associated with--					
	Cull	Breakage	Bole wound (1)	Goosepen (2)	Broken top (3)	Bole wound + broken top (1 + 3)	Goosepen + broken top (2 + 3)	Breakage
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
21-30	13	2	14	19	24	45	45	2
31-40	9	4	14	21	25	46	48	4
41-50	7	6	15	24	25	47	51	5
51-60	5	8	15	27	26	48	54	5
61-70	4	9	16	30	27	49	58	5
71-80	4	10	17	34	28	51	63	5
81-90	3	11	18	38	30	54	69	5
91-100	3	11	20	42	32	57	75	4
101-110	3	12	22	47	35	61	83	4
111-120	3	12	25	52	38	66	91	4
121-130	3	12	29	58	41	72	100	3
131-140	3	12	33	64	45	78	100	3
141-150	3	12	38	71	50	84	100	2
151-160	3	12	44	80	56	90	100	2

1/ Based on the average cull associated with specific cull indicators.

DISEASE SURVEY DATA SHEET

FOR TEMPORARY RANDOMLY SELECTED PLOTS

TIMBER PLOT

Plot Name Sheep Camp Creek

Distance from and Side of Road 21-TRP Azimuth 324

GENERAL DATA

1. Subregion	X	2	9. Site	X	2
2. County	XX	32	10. Elevation	XX	45
3. Ownership	XX	01	11. Aspect	X	7
4. National Forest	XX	10	12. Topography	X	2
5. Plot No.	XXX	100	13. Type	XX	05
6. Plot Size	X	3	14. Stand Size Class	X	1
7. Measurement No.	X	1	15. Stand Treatment	X	3
8. Year	XX	61	16. Density	XX	32

FACILITATING DATA

T 27N R 8E S 23 M Mt. Dia.
Site Tree: Sp. 01 Dbh. 30.2Ht. 105 Age 95
Number of Trees on Plot 25-0
Data by: D. R. Miller
Notes by: H. H. Bynum
Date 7/15/61

X indicates number of digits in item code

TREE DATA							PATHOLOGICAL DATA																					
17	18	19	20	21	22	23	24		25		26		27	28		29		30		31		32		33		34		35
							Injury		Bole Wounds		Abnormal Growth			Heart Rot		Dwarf-Mistletoe		Leaf Diseases		Rusts		Root Diseases		Physiolog. Diseases		True Mistletoe		Misc. Diseases
Tree Number	Species	1/10 Inch Dbh	Dunn Tree Class	Keen Tree Class	Risk Class	Merch. Class	Kind	Intensity	Kind	Intensity	Kind	Intensity	% Cull, Bd. Ft.	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Kind
XXX	XX	XXXX	X	XX	X	X	XX	XX	XX	XX	XX	XX	XX	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX	XX
001	11	0150	2	12	1	1	04	05	01	04	01	02	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	01	00
002	01	0259	1	21	1	1	00	--	--	--	--	--	00	0	-	-	0	6	1	0	-	-	-	-	-	-	-	-	00
003	31	0235	1	22	1	1	00	00	33	44	07	01	47	9	0	-	0	7	3	0	-	-	-	-	-	-	-	-	00
004	31	0160	2	12	1	1	03	05	00	00	07	01	00	0	-	-	0	5	2	0	-	-	-	-	-	-	-	-	00
005	31	0120	1	12	1	0	00	--	--	--	--	--	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
006	11	0282	1	13	1	1	00	00	04	04	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	01	00
007	01	0157	1	12	1	1	00	--	--	00	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
008	11	0168	1	23	1	1	00	00	04	04	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
009	13	0120	2	13	1	0	00	--	--	00	16	44	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	02	00
010	01	0273	1	21	1	1	00	--	--	00	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
011	01	0135	1	12	1	0	00	--	--	--	--	--	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
012	01	0125	2	12	1	0	00	--	--	00	07	01	00	0	-	-	0	6	1	0	-	-	-	-	-	-	-	-	00
013	01	0110	6	13	1	0	06	04	00	00	07	01	00	0	-	-	0	6	2	0	-	-	-	-	-	-	-	-	00
014	31	0230	1	22	1	1	00	--	--	--	--	--	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
015	31	0182	1	11	1	1	00	--	--	--	--	--	00	0	-	-	0	5	2	0	-	-	-	-	-	-	-	-	00
016	31	0128	1	11	1	0	00	--	--	--	--	--	00	0	-	-	0	5	2	0	-	-	-	-	-	-	-	-	00
017	13	0115	1	11	1	0	00	--	--	00	77	11	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	01	00
018	31	0122	1	12	1	0	00	--	--	00	07	02	00	0	-	-	0	5	2	0	-	-	-	-	-	-	-	-	00
019	13	0135	1	11	1	0	00	--	--	--	--	--	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	01	00
020	51	0258	2	23	1	1	06	04	01	04	07	02	08	5	0	-	-	-	0	6	6	0	-	-	-	-	-	-	00
021	01	0210	1	23	1	1	06	05	00	00	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
022	01	0216	1	22	1	1	00	--	--	00	07	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
023	31	0116	2	11	1	0	00	--	--	00	07	01	00	0	-	-	0	5	2	0	-	-	-	-	-	-	-	-	00
024	01	0132	1	11	1	0	06	04	00	00	07	01	00	0	-	-	0	6	2	0	-	-	-	-	-	-	-	-	00
025	13	0146	1	13	1	0	00	--	--	--	--	--	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	02	00

DATA FOR BROADLEAF TREES

026	73	0142	0	0	9	1	00	--	--	00	01	01	00	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	00
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028																													
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DISEASES ON OFF - PLOT CONIFERS

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032																													
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Length of strip 16 1/6

DISEASE SURVEY DATA SHEET

POLE PLOT

(Conifers from 5-10.9 inches DBH)

Subregion X 2 Year XX 61 Plot Name Sheep Camp Creek
Plot No. XXX 100 Date July 15, 1961 Data by: D. R. Miller
Plot Size X 3 Notes by: H. H. Bynum

	TREE DATA					PATHOLOGICAL DATA																						
						Injury		Bole Wounds		Abnormal Growth		Heart Rot		Dwarf-Mistletoe		Leaf Diseases		Rusts		Root Diseases		Physiolog. Diseases		True Mistletoe		Misc. Diseases		Notes
Tree Number	Species	1/10 Inch Dbh	Dunn Tree Class	Keen Tree Class	Risk Class	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Intensity	Kind	Kind	
XXX	XX	XXXX	X	XX	X	XX	XX	XX	XX	XX	XX	X	X	X	X	X	X	X	X	X	X	X	X	X	X	XX	XX	
001	31	0072	0	12	1	00	--	--	--	--	--	-	-	-	0	5	4	0	-	-	-	-	-	-	-	--	00	
002	31	0079	0	12	1	00	--	--	--	--	--	-	-	-	0	5	2	0	-	-	-	-	-	-	-	--	00	
003	01	0101	0	12	1	00	--	--	00	07	01	0	-	-	-	-	-	-	-	-	-	-	-	-	-	--	00	
004	31	0059	0	11	1	00	--	--	--	--	--	-	-	-	0	5	2	0	-	-	-	-	-	-	-	-	--	00	
005	01	0076	0	11	1	00	--	--	--	--	--	-	-	-	0	6	2	0	-	-	-	-	-	-	-	-	--	00	
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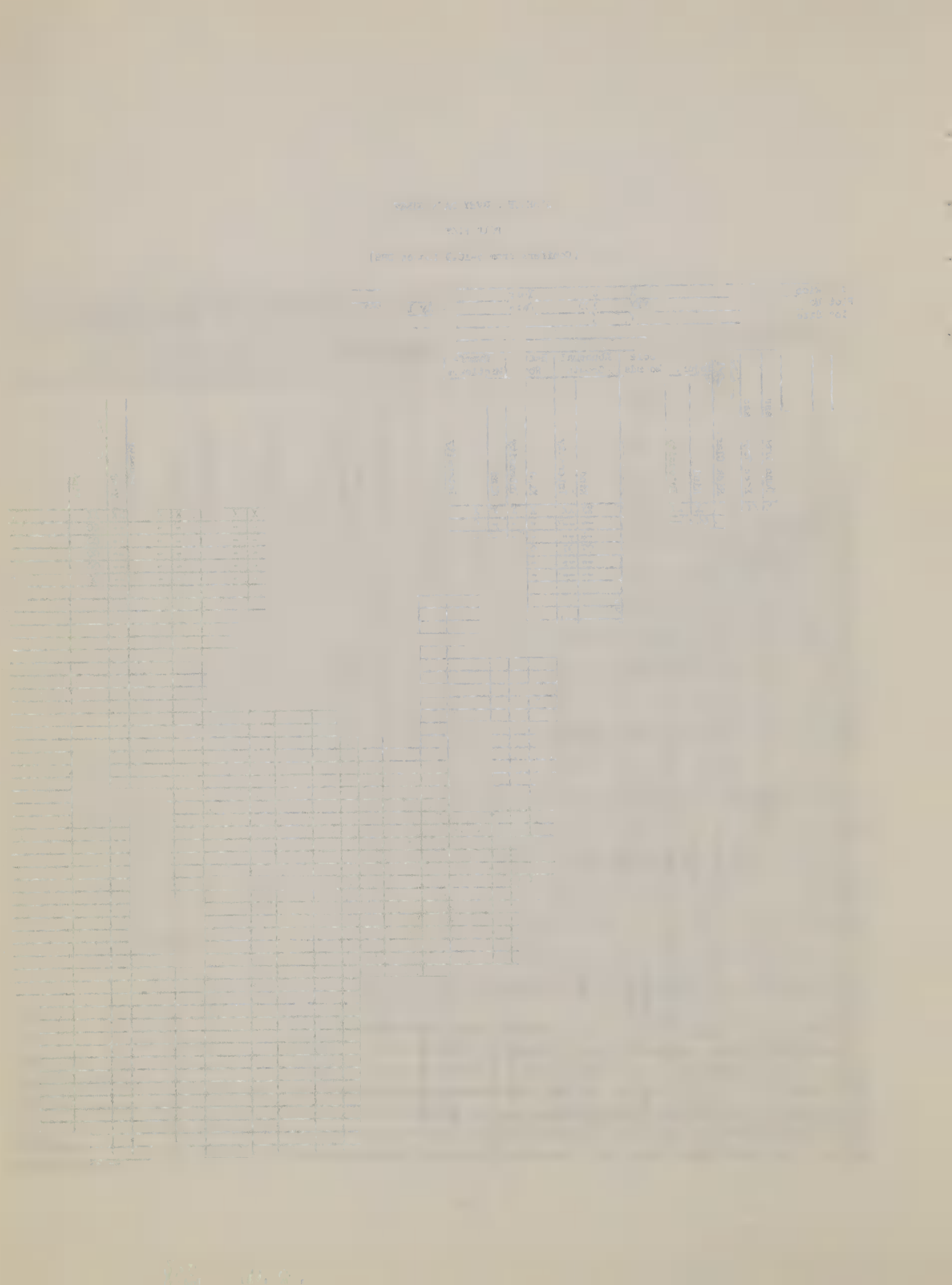

DISEASE SURVEY DATA SHEET

Seedling and Sapling Plot

(Established Conifers up to 4.9 Inches DBH)

Subregion X 2 Year XX 61 Plot Name Sheep Camp Creek
Plot No. XXX 100 Date July 15, 1961 Data by: D. R. Miller
Plot Size X 3 Notes by: H. H. Bynum

Number of Trees	Species	Size Class	Injury Kind	Injury Intensity	Disease Kind	Disease Intensity	Tally	Notes
XXX	XX	X	XX	XX	XX	XX		
		1						
008		2	12	93	00	00	☐	
004	31	3	12	93	00	00	∷	
005		4	12	92	00	00	∷ —	
003		5	12	33	00	00	∴	
002		6	00	--	--	00	‥	
002		7	00	--	--	33	‥	
24		1						
		2						
		3						
		4						
		5						
		6						
		7						
		1						
		2						
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		4						
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		7						
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		3						
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		6						
		7						

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DIAGRAM OF SAMPLE TIMBER PLOTS

Figure 1. Example one shows a full 50-chain plot and the procedure used to keep it within boundary limits.

Example two shows how a plot is discontinued for 4 chains when crossing a road and how it is reversed when the boundary of the timber belt being sampled is reached.

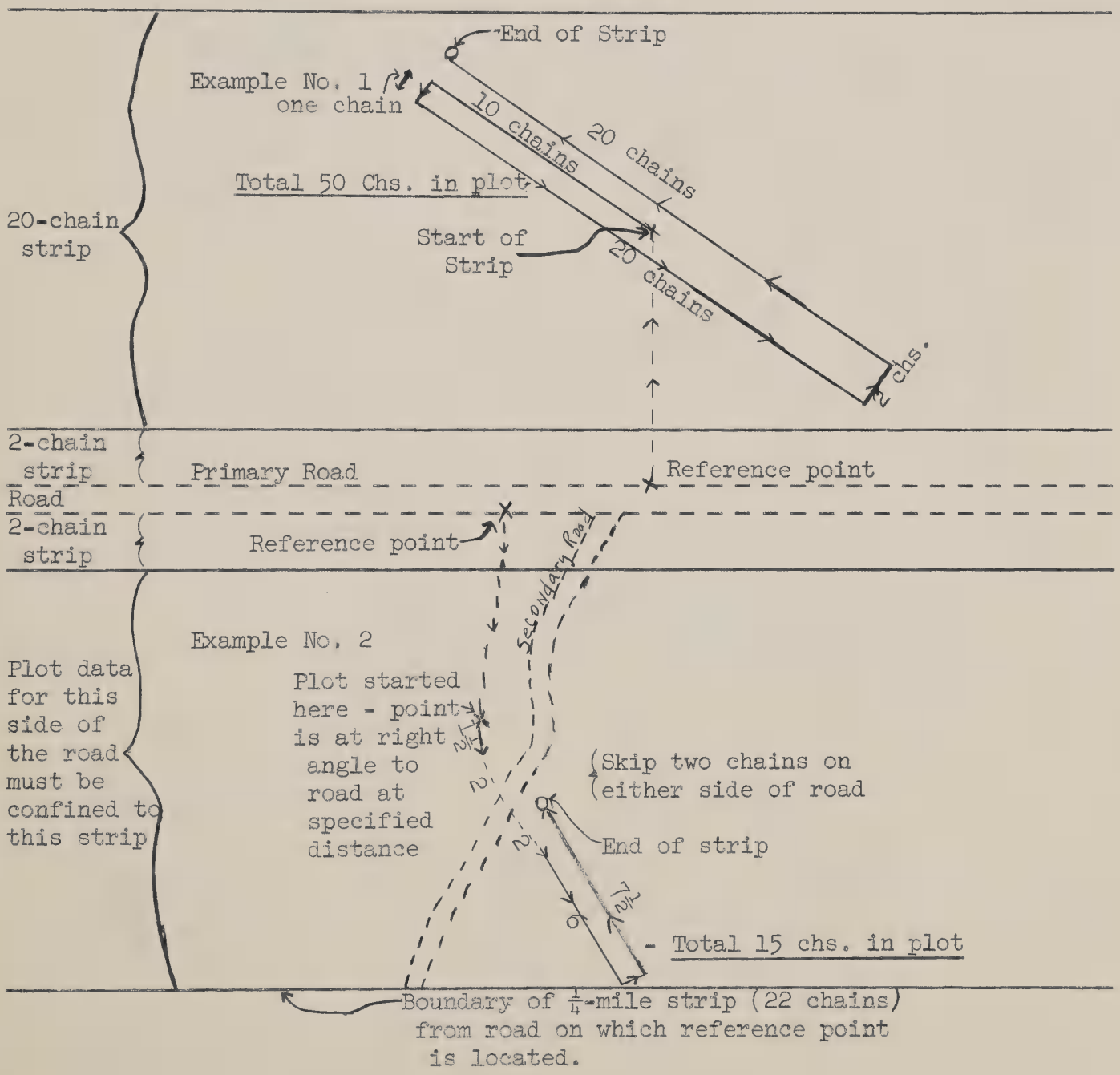
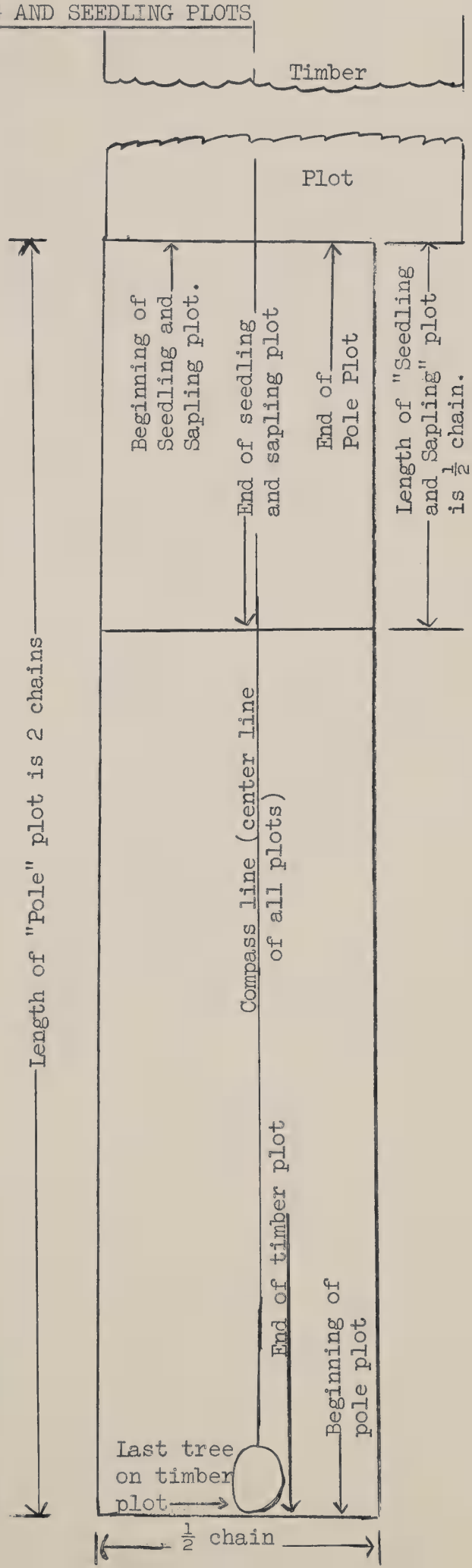


DIAGRAM OF POLE, SAPLING AND SEEDLING PLOTS

Sketch showing relationship of "timber plot" with "pole plot" as well as relationship of "pole plot" with "seedling and sapling plot".

Note the bark of the last tree on the timber plot is the end of that plot and the beginning of the pole plot.

The end of the pole plot and the beginning of the seedling and sapling plot is a common boundary.



EQUIPMENT LISTS

Equipment Carried By:

Pathologist

1. Binoculars (7x50 central focusing)
2. Hand axe and belt sheath
3. Abney hand level
4. Hand lens
5. ~~Hand~~ microscope - 40-60 power
6. Pencil and notebook
7. Collection envelopes
8. Hard hat
9. Quart canteen and belt (if needed)
10. Diameter tape
11. 6-foot steel rule

Assistant

1. Compass and case (Brunton or Silva)
2. Tally register
3. Pencil
4. Tatum
5. Forms
6. Increment borer (15")
7. Snake bite kit
8. Hard hat
9. Quart canteen and belt (if needed)
10. Hand lens
11. Dragline about 1/2 chain in length

Equipment Available in Pickup

1. First aid kit
2. Pruning shears (Wiss) - (2 shears)
3. Pruning saw " "
4. Camera, tripod, film, filters, etc.
5. Chain (2-chain with topog. trailer on reel)
6. Chain menders
7. Altimeter
8. Extra compass
9. Extra tally register
10. Extra increment borer
11. Extra hand level
12. Notebooks and pencils
13. Forest Pathology - Boyce
14. Manual of Flowering Plants - Jepson
15. Manual of Pacific Coast Trees - McMinn & Maino
16. Plant press
17. Canteen, gallon
18. Axe, double bit and sheath
19. Shovel
20. Maps, folding, cloth backed, for each forested area in the State (Forests and State maps of coastal Counties)

Equipment Available in Pickup (Cont'd)

21. Scotch tape (1/2 - 3/4)
22. Roll of green plastic dots
23. Diameter tape
24. Draw-sheet record book
25. Tape recorder with extra rolls of tape
26. Extra dragline
27. Index of Plant Diseases, Handbook 165
28. Mailing cans, specimen - insect type (3 cans)
29. Filing envelope (for completed forms)
30. Forms, disease survey (in filing envelope)
31. Manual for Conducting Disease Survey
32. Pliers - 8"
33. Crescent 10"
34. Screwdriver 8"
35. Screwdriver, Phillips 8"
36. Machine, staple (and staples)
37. Solvent
38. Oil for oiling diameter tape, increment borer, and chain